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The Engineering and Mining Journal

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The Utah Copper Co.

The communication from Mr. Steele, that is published elsewhere in this issue, is a temperate criticism of the position of the Utah Copper Co. As we have remarked in previous articles, the doubt respecting this company pertains chiefly to the matters of the deferred charges and to amortization of plant. The deficiency upon the latter score is, we think, beyond dispute. The mills of the company have now been in operation for nearly five years. During this period, the outlays upon them have been carried to capital account, which has consequently been steadily increased. There has been, of course, the insidious explanation that capacity has been increased, and to a certain extent there is truth in that, but every mining company finds it necessary to put money into its plant and most companies charge this to operation, where it belongs, because the money thus expended is not an addition to capital, but is a replacement of things that have been worn out. Besides this there ought to be accumulated a fund to provide for total replacement sooner or later. Besides the mere keeping of things in repair and in running order, the time comes when the whole plant must be discarded and a new one substituted. Thus, at the present time, the United Verde company is building a new smelting works, and the Anaconda company is about to replace its Great Falls works. There is no reason to believe that the Utah Copper Co. is going to be more fortunate in this respect than other companies have been, and in disregarding this principle it underrates its cost of production by a considerable amount.

The matter of the deferred charges on account of stripping is more complicated. In principle the management of the company is, in the main, correct. If we could imagine the Calumet & Hecla opening its entire conglomerate lode so that the whole would be ready for mining, even though extraction would not be completed for 20 years yet, it would be manifestly erroneous to charge the entire cost of development to the concurrent mining. In a vein or lode mine that would not be done, but in the case of a deposit like that of the Utah Copper Co., and with a method of mining as adopted by it, an analogous procedure must necessarily be followed. We think that the officers of the Utah Copper Co. fail to make things quite clear to their stockholders, because of their presentation of too many confusing details, and a general overstatement of their case. A more concise report would really be better.

As we understand the situation, the company had a total of about 40,000,000 cu.yd. of overburden to remove from about 200,000,000 tons of ore, this estimate of overburden allowing for what we may call the dead slopes. If we assume one cubic yard of overburden to be two tons, the ratio of overburden to ore is as 2:5. If the cost of shoveling both ore and overburden were 25c. per ton, and if the removal of each were being done proportionately, there would be for every five tons of ore two tons of overburden, costing 50c., or 10c. per ton of ore obtained. The company began by allowing 5c. for this, but later raised the allowance to 7½c. In fact, however, overburden has been removed at a greater rate than ore. Up to the end of 1911, a little more than 12,600,000 cu.yd. of overburden had been removed, and only about 16,000,000 tons of ore. There has consequently been an enormous anticipation of operating expense. Assuming this to have been financed by a special fund, rather than by a special bookkeeping account, the expense charged off annually to operation ought to be subject to interest on the total sum advanced for this special fund. Nothing of this kind seems to have been allowed, nor does there seem to have been any allowance for the increasing cost of removing overburden, as it must be carried further and further away from the mine, not for any unforeseen adverse contingencies. We understand Mr. Steele's criticism to have reference to such points

as these, rather than to any fundamental fallacy in the method of bookkeeping adopted by the Utah Copper Co.

The figuring that we have done in the foregoing paragraph is intended to be more by the way of illustration than to arrive at any hard-and-fast deductions. We think that if the Utah Copper Co., in its next report, should discuss the matter in somewhat the same way, its stockholders should be satisfied. At the end of 1910, the company estimated that it had developed 203,500,000 tons of ore. At the end of 1911, during which year 4,680,000 tons of ore were extracted, it was estimated that there remained 301,500,000 tons of fully developed and partially developed ore. We are quite ignorant as to how this additional development of ore affects the ratio of overburden to ore.

In drawing attention to these points, we have no idea of disparaging the wonderful property of the Utah Copper Co., or the remarkable achievements of Mr. Jackling and his associates in developing it. Scarcely more than 10 years ago this orebody was disregarded. It is now recognized as one of the largest known deposits of copper ore, and the company owning it has become the second largest producer of copper in North America. Ten years ago but few persons would admit that ore yielding but 20 lb. of copper per ton could be worked under the conditions of Utah. In making this a commercial ore, new methods of mining and milling have been developed by bold imagination, and have been carried out upon a colossal scale to a successful outcome. In this, Mr. Jackling has been a leader, and the credit that is due to him ought in no wise to be minimized. But while recognizing the magnitude of this mine and the enterprise and ability of its management, we still suffer from uncertainty as to what its real earning power is likely to be.

Mining or Buying Ore?

The reduction in prices of Lake Superior ore sold on the open market this season has led to reports that some of the companies which operate their own mines will buy ore instead of mining it to cover at least part of their requirements for the season. A Mesabi bessemer ore brings this season $3.50 and a nonbessemer $2.85 f.o.b. Lake Erie port. The fixed deductions from this are 60c. for freight to the Lake Superior port; 50c. for Lake vessel freight; 10c. for unloading charges; a total of $1.20, leaving $2.30 and $1.65, respectively, to pay for mining and loading and for royalty or value of the ore in the ground. This, of course, assumes that the ore is up to the base standard of 55% iron for bessemer and 51.5% for nonbessemer ores. These seem low allowances, but we have no doubt that the actual cost to most of the companies mining their own ores will not exceed the figures given, unless the mining is done under excessive royalties.

The Iron and Steel Division of the American Institute

In the establishment of an iron and steel division under the charge of a special committee, the Council of the American Institute of Mining Engineers has taken a step, the necessity of which has been apparent for a long time. The work of the Institute and its members has come in recent years to cover such a variety of subjects and such a wide scope that no one man or set of men could be expected to cover it all, or even to be interested in all its branches. Of course, there is a certain relation among them all, but the mining and handling of iron ores and the metallurgy of iron and steel are quite sufficient to absorb the study and energy of an engineer; and they differ at so many points from the treatment of the other metals that one cannot well be deeply interested in both.

It is not impossible that this action may have averted the formation of a separate society by the iron and steel men, who now have no special technical representative outside of the Institute. The American Iron & Steel Association is entirely a statistical society, and the new Iron & Steel Institute is rather a trade association—with some sociological work brought in incidentally—than a technical society. The establishment of the Iron & Steel Division as a working unit will permit a concentration of interest which ought to be of great advantage to those interested; and which should, at the same time, hold them in allegiance to the Institute as a whole.

Without knowing what, if any further action the Council may have in mind, a still further differentiation of the work would seem to be both possible and probable. The formation of a coal-mining section or division would be a natural sequence to the present action.

The formation of the new section is, we believe, a necessary and judicious measure. We have every reason to hope and believe that, under the charge of the capable committee selected, its results will fully justify the action of the Council.

Proposed Arizona Legislation

A bill regulating metalliferous mining and providing for mine inspection, now pending in the legislature of Arizona, follows, in the main, the general draft for such legislation recommended by the committee originally appointed by the American Mining Congress and now serving in the U. S. Bureau of Mines. The proposed legislation has therefore had the benefit of careful preliminary consideration. The modifications that have been made in the Arizona bill are partly good and partly bad, but, on the whole, the proposed legislation is commendable and is a distinct improvement upon similar legislation that has previously been enacted in the other mining states. This bill has been introduced by Mr. Hall.

We are unable to give the same approval to the Kinney bill, which prohibits the employment of non-English-speaking workmen in the mines. Such a prohibition was carefully considered by the engineering committee to which we have referred, and was condemned by it, on the ground that it would impose a serious hardship upon the mine operators and upon men, would be difficult to carry out, and is unnecessary, anyway.

We regret that it became necessary to interrupt the series of articles by Prof. H. C. Jones, the publication of which in the JOURNAL has attracted general and appreciative attention. The next of these articles will appear in the issue of May 18, and the following articles in the issues of May 25, June 1 and June 8.

The copper report showing an increase of only 2,698,472 lb. in April is chiefly noteworthy for the continued small production. The mystery of what has become of the new copper promises to rival that of the blowing up of the "Maine."

The Highgrade Boom

SAN FRANCISCO CORRESPONDENCE

In the San Francisco *Chronicle,* of Apr, 5, a note from the State Mining Bureau was published, calling attention to the extravagant statements made by promoters concerning the certain fortunes to be made by investment in mining companies at Highgrade, Modoc County, Calif. The *News,* of Carson City, Nev., has taken issue with the state mineralogist of California as to his attitude on Highgrade and suggests that his scalp be taken and that he be torn limb from limb, as according to the *News* this is about what would have happened to him had he been in southern Nevada at the time of the Goldfield boom and had he taken a similar position against fakers there. Mr. Storms has issued the following open letter addressed to the editor of the Carson City *News*:

Sir: Your editorial remarks on the position I have taken regarding the "boosting" of Highgrade camp and stocks of mining corporations claiming to own properties there, has come to my attention, and I think it proper to place myself on record through the medium of your columns as to the attitude I shall take in all such cases. It is the purpose of the California State Mining Bureau and the duty of the state mineralogist, to foster and promote the legitimate mineral industry of California in every possible way. I also consider it my duty to protect those who may be induced to buy stocks in mining companies of doubtful repute, and this I propose to do even though I "lose my scalp and be torn limb from limb," as so cheerfully suggested in your editorial of Apr. 11.

I find certain mining publications advertising Highgrade as a camp where success is certain. I do not blame the publishers of these papers for accepting this "business" as that is what the papers are printed for, to make money for their owners; but I do blame irresponsible promoters for the untruthful statements made by them and warn all intending investors to investigate carefully first. There is no doubt that there is gold at Highgrade, the principal property there at present being that of the Fort Bidwell Consolidated Mining Co., which has a 10-stamp mill. The camp will probably develop other good mines, I hope it will; but I repeat what I have already said, that the present knowledge of the camp does not justify the strenuous attempts being made to create a stampede to that district where the snow is still deep, for if a rush does occur it is bound to result in great hardship to many, besides the loss of money, which most of those joining in the rush can ill afford. They who profit by the stampede are the promoters, the transportation companies and the saloon men; that others will, is doubtful. I have been in many mining camps and an experience of many years in this sort of thing makes it unnecessary for me to visit it to know and say that every foot of ground that shows a sign of mineral, and much that does not, has long since been located on general principles.

I note you conclude your editorial by advising me to remain in California, as "knockers" are not wanted in Nevada. I will respectfully call your attention to the fact that Highgrade camp is in California and is within the jurisdiction of my official inquiry. I wish Highgrade well, but I also wish the investors well, and it is my intention to protect them in this, as well as in every other attempt of irresponsible boosters, to sell stock in companies organized not to mine, but to exploit the public.

W. H. STORMS,
State Mineralogist.

A more recent development in the situation is the publication of a second letter by Mr. Storms, addressed to N. E. Guyot, a Denver assayer connected with Highgrade. From Mr. Storms' answer it is not difficult to infer in general the contents of Mr. Guyot's initial letter to him. This letter of Mr. Storms covers much the same ground as the one reproduced above, but some of the closing sentences are particularly interesting. He says:

I have before me several copies of the Denver "Mining Record," in which appears a number of advertisements of stockbrokers and others. I say without hesitation that up to this time development at Highgrade does not justify the promises made in these advertisements. . . .

American Institute of Mining Engineers

The Council of the American Institute of Mining Engineers, at its meeting on Apr. 26, established an Iron and Steel Division to represent the interests of the Institute in the mining and metallurgy of iron and steel; its business to be in charge of the following committee, upon which shall rest the responsibility of securing papers and discussions on iron and steel for the meetings of the Institute: Charles Kirchhoff, chairman; Charles F. Rand, vice-chairman; Bradley Stoughton, secretary, 165 Broadway, New York; John Birkinbine, James Gayley, Henry D. Hibbard, Henry M. Howe, Robert W. Hunt, Julian Kennedy, Charles K. Leith, Richard Moldenke, Joseph W. Richards, F. W. C. Schniewind, Leonard Waldo, William R. Webster and Felix A. Vogel.

The committee has met and formulated plans for carrying out its intention of securing papers and discussions dealing with all phases of the mining and metallurgy of the ferrous metals, to such an extent as will make the American Institute of Mining Engineers the foremost iron and steel association in America, useful alike to the theoretical as well as the practical iron and steel man. The following subjects have been suggested: Geology; mining and preparation of ores; concentration; nodulizing, sintering and briquetting; manufacture of coke and other fuels; refractory materials; blast furnace; bessemer, openhearth and electric furnace practice; the duplex process; treatment, physics and chemistry of iron and steel, including metallography. A campaign has already been started to secure papers and discussions on: Alloy steels; heat treatment of steel; the duplex process; the thin-lined blast furnace; fuel gas for openhearth furnace; ore concentration; manufacture of pig iron; mechanical charging of blast furnaces; gas producers; charcoal iron; electric furnaces; recent improvements in openhearth furnaces and practice. The committee will use its utmost endeavors to bring the papers presented on iron and steel to the attention of all members qualified to discuss them, and to stimulate a continuance of the discussion until all available data and information of interest have been secured for the *Transactions* of the Institute.

Cleveland-Cliffs Iron Co. School

NEGAUNEE CORRESPONDENCE

The Cleveland-Cliffs Iron Co. has announced that James W. Swent, of Oakland, Calif., a graduate of the Michigan College of Mines, will have charge of its new school for miners, of which the JOURNAL has made editorial mention. The plan is to train the company's employees so that shift bosses and foremen can be picked from them.

Classes will be held in the evening, one section at Ishpeming on the Marquette range and one section at Gwinn on the Swanzy range. A large number of employees has already enrolled in the school and more have signified their intention of doing so; all employees who can speak English are eligible; the expenses of the school will be borne by the company. It will probably be June 1, before regular classes will be held.

A New California Gusher

SAN FRANCISCO CORRESPONDENCE

The McKee No. 4 well, owned by the Standard in the Midway field, California, came in as a gusher on April 25. The oil ran the full capacity of the 10-in. pipe and the estimated rate of flow was 30,000 bbl. per day. Sumps and reservoirs were immediately constructed to take care of the excess oil over a normal production. The sand was entered at 2406 ft. and the well began gushing 10 to 15 ft. deeper. The well is situated about a mile north of the Standard main pumping station in the narrow valley between the two ranges of Buena Vista hills.

The *Ebano News,* a little journal published by employees of the Huasteca Petroleum Co., of Mexico, claims that the Casiano well No. 7 is the greatest well in the world. For the last 17 months it has produced 11,000,000 bbl. under steadily increasing pressure, and now its average daily output is 25,000 barrels.

Transvaal Mining Notes

JOHANNESBURG CORRESPONDENCE

The Brakpan mines continue to give good returns and to show low working costs. About 42,000 tons per month are milled, the grade being 28s. 9d., and working costs 17s. 9d. per ton.

In a recent letter I mentioned the West Rand Consolidated as having so far proved a disappointing proposition. There are 2000 claims covering 2½ miles along the reef and the milling plant consists of 100 stamps and four tube mills. Shortage of native labor has been a drawback, there being a shortage of 1000 natives and 75% of the reef mined is broken from narrow and broken stopes by machines. About 4000 ft. of development work is accomplished per month at a cost of 2s. per ton developed. At the end of last year the ore developed was 1,124,631 tons valued at 5.54 dwt. over 40 inches.

Recent returns from 28,000 tons per month crushed show a grade of 23s. with working costs 19s. 3d. As there are over 2,000,000 shares, prospects of dividends on the present scale of working and present costs are remote. Last year working profit totaled £50,000 and capital expenditure £96,700.

The historical Ferreira mine is to be absorbed by the Ferreira Deep. In this way another funeral is avoided, a deathbed marriage being arranged instead. The ore reserves in the Crown mines total 10,124,172 tons, averaging 7.25 dwt. per ton. On capital account £500,000 was expended last year and 71,023 ft. of development was accomplished. The cost per ton at the Main Reef West mine was 22s. 1.7d., while last quarter's development of 2058 ft. averaged only 5.9 dwt. over 48 in. There are 671,000 tons developed.

The latest developments in the 18th and 19th levels of the Globe & Phoenix mine, in Rhodesia, continue to be disappointing and though the consulting engineers furnish favorable reports rumor is persistent that the oreshoots are shortening in the 8th level of the mine.

TIN AND DIAMOND MINING

Tin mining is dull, but the Zaaiplaats mine continues to give good returns. Last month 2679 tons were mined and concentrated at a cost of £2900 for a yield of 138 long tons of tin ore assaying 68% tin. The Rooiberg mine treated 1573 tons for 61 tons of concentrates assaying 68% tin for £3015 profit.

The rich Roberts Victor diamond mine, which at one time was the richest in South Africa, is practically finished as the small pipes contracted in depth and became unprofitable. Several thousand people are still winning about £30,000 worth of diamonds per month from the surface wash covering the farms in the neighborhood of the Vaal River, near Bloemhoff, on the line between Kimberley and Johannesburg. An output of 850,000 karats is expected this year from the German Southwest Africa fields against 900,000 karats for 1911. These fields show signs of exhaustion.

The Leuschner Flotation Process

The Leuschner flotation process, a combination of the oil- and acid-flotation processes, has been in successful operation at the Friedrichssegen and Ludwigseck mines, in Germany, for some time, according to *Glückauf*, Mar. 9, 1912. It is claimed that both oil and acid consumption are reduced, and the necessity for vacuum is done away with. Gas for flotation is generated from carbonates. If these do not exist in sufficient amount in the ore, finely divided carbonates are mixed with it. Oil is added in the usual manner.

The disadvantage of the process is that it is not applicable to mixed sulphides, except, we understand, as a means of getting rid of the gangue, and other methods must be adopted for final separation. Thus, on a Thuringian hornblende, carrying 0.8% Pb and 2.9% Zn, the concentrates carried 8.4% Pb and 24.7 of Zn; the tails traces of lead, 0.8% zinc.

At Friederichssegen, the process has superseded Wetherill magnetic concentration on a blende mixed with spathic iron ore, the gangue being quartz and graywacke. The heads are a mixture of sand and slime up to 1 mm. diam., and a zinc content of 10 to 15%. The concentrate carried from 47 to 50% of Zn, and only 0.3% remains in the tailings, giving an extraction of 90 to 97%. The acid used is 60° Glover acid, and the bath has a specific gravity of 1 to 2° Bé, at a temperature of 60 to 80° C. From 40 to 60 kg. of acid are used per ton of ore. The concentration of the bath depends on the solubility of the carbonates. The oils used are the cheapest grades obtainable, and as the consumption is proportional to the metal contents of the ore, the expense for oil is low with poor ores. On the 10 to 15% Friedrichssegen ore the oil consumption is four to six kilograms per ton of ore. The oil is not recovered after use.

At the Ludwigseck mine, a mixture of galena and blende mixed with spathic iron ore and a quartz and graywacke gangue is jigged, giving a galena concentrate, blende middlings and a worthless tailing. The blende is then concentrated by the Leuschner process.

At Friedrichssegen, the total working costs, including transportation of ore from shaft to works, but exclusive of amortization and interest charges, is $0.96 to $1.42 per ton of ore. Steam costs $0.07 to $0.17. The cost of a plant, designed for 10 to 15 tons per 10-hour shift, is $1250 to $1500, and two to three horsepower is sufficient for running the plant.

An experimental laboratory has been established at Friedrichssegen, where various copper, lead and zinc sulphides have been experimented upon with success. One example has been given. Others were: A copper pyrite, carrying 5.1% Cu, gave a concentrate 24.9% Cu, with 97.60% recovery; and a boulangerite, carrying 9.8% Pb and 3.8% Sb, gave a concentrate, carrying 27.4% Pb and 9.3% Sb, with a joint recovery of 98.4 per cent.

Southern States Phospnate Deposits

A recent report of the Bureau of Soils is devoted to the phosphates of Tennessee, Kentucky and Arkansas. Due to large-scale working with modern machinery and mining methods, the Tennessee brown-rock deposits which several years ago were given a life of only six or seven years, promise to yield as much rock as has already been extracted. The average price of 72% brown-rock phosphate, f.o.b. mines, is about $3.75 per ton.

Actual mining operations in Kentucky will probably begin in 1912. The development of the Kentucky field has been hindered by the exorbitant demands of the holders of the phosphate properties, which were the outcome of large sums paid for options in the vicinity of Midway, several years ago.

Only one company has mined much Arkansas phosphate. This was done about 12 miles northwest of Batesville, where numerous tunnels have been run into a hill on a creek bank. From the deposit thus opened, about 50,000 tons have been taken out. The deposit of high-grade rock is 3½ to 4 ft. thick. In Arkansas mining, the phosphate stratum underlying the main bed is either left untouched, or taken out and discarded. There is no local market for ground rock at present, to make the low-grade material profitable. Mining operations in Arkansas should increase, as a fertilizer factory in Little Rock is preparing to increase an already large plant.

Colorado Gold Production

The gold production of Colorado for the year ended Dec. 31, 1911, is given as 921,274 oz. by the Colorado Bureau of Mines. The production by counties was as follows: Teller, 511,607 oz.; San Miguel, 118,760; Ouray, 93,603; Lake, 56,150; Gilpin, 38,107; Clear Creek, 26,933; San Juan, 15,634; La Plata, 13,897; Summit, 13,556; Mineral, 8706; Boulder, 7888; Gunnison, 6650; Chaffee, 3186; Park, 2844; Eagle, 2001; Costilla, 1082; Dolores, 362; all others, 309 ounces.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Utah Copper Costs in "Lake Superior Figures"

The Utah Copper Co. in its annual report states that it produced copper for 8.07c. per lb. in 1910 and 7.87c. in 1911. In summing up the copper situation in his report to the state of Michigan in 1911, J. R. Finlay, in reference to the porphyry copper mines said: "So far as costs are concerned, the porphyry mines are in essentially the same situation as other mines. Some can produce copper cheaply and others cannot. It is highly doubtful if their average cost will even be as low as in the Lake Superior district." The average cost of production in the Lake district during the five-year period 1906-1910 was 10.1c. per lb. for all the profitable mines. The Utah Copper Co. claims that the cost figures reported cover costs of every kind and description, but before it is fair to compare any two cost records it is only fair to see if the figures given for each represent the same costs. It is the custom in the Lake Superior district to charge every expenditure to operations. Their reports are by far the most satisfactory statements issued by any of the American mining companies; the total receipts and expenditures are itemized so that one can see at a glance the profit or loss for the year. No attempt is made to defer charges. Let us take two of the mines in this district as examples, the Calumet & Hecla, a mature property; and the Ahmeek, a new one.

During the five years mentioned it cost the Calumet & Hecla 8.95c. per lb. to produce 410,614,189 lb. of copper from 13,185,376 tons of rock averaging 31.2 net lb. of copper per ton. The total cost was $36,662,696, made up as follows: Mining, transportation and milling, $26,850,772, $2.04 per ton or 6.54c. per lb. of copper; construction, $2,889,570, or 0.74c. per lb.; smelting, refining and commissions, $4,684,975, or 1.14c. per lb.; and general expenses, $2,237,379, or 0.53c. per lb. of copper. It must be borne in mind that these figures represent every expenditure during this period, so that the total cost as given, subtracted from the gross receipts, $61,313,175, leaves the actual net profits, $24,650,479; therefore there is no disputing the reported cost of production, 8.95c. per pound.

The Ahmeek Mining Co. produced 35,911,797 lb. of copper, during the same period, from 1,722,281 tons of rock, having a net yield of 20.9 lb. per ton at an average cost of 13.3c. per lb. of copper. But like the Calumet & Hecla figures, this cost includes all expenditures, which were partly absorbed in equipping the property, as will be noticed by the construction item in the costs herewith: Mining, transportation and milling, $3,002,075, or $1.74 per ton of rock, or 8.36c. per lb. of copper; smelting, refining and commissions, $411,804, or 1.15c. per lb.; construction, $1,226,945, or 3.42c. per lb.; and general expenses, $145,192, or 0.40c. per lb. of copper. The total expenditures were $4,786,018, which, subtracted from the gross receipts, $5,134,777, gives the actual profit, $348,758 for the five years. In the case of the Ahmeek the cost will be lower in the future owing to a reduction in construction at the property; in fact, the cost reported for 1911 was 7.17c. per lb. but the amount spent during the year for construction was much below the average required for the Lake Superior mines, 0.8c. per lb. of copper. It seems safe to say in regard to the future costs, that if the yield is maintained at the present amount and construction figured at the average cost, Ahmeek will produce copper at a cost of 7.5 to 8c. per lb. with a certainty of an increase if the yield falls below the present amount.

The Utah Copper reports are elaborate and give many figures, but it cannot be said that they are plain to the average layman who tries to figure out the net results. It is a large property and owing to various investments and holdings the accounts are necessarily numerous; however, let us see what its costs would be in the plain language of the Lake Superior copper-mine reports.

For 1910 the report gives the operating expenses as $7,819,477, for a production of 84,502,475 lb. of copper from 4,340,245 tons of ore yielding 19.5 lb. net of copper per ton. This indicates a cost of 9.25c. from which 1.18c. per lb. is deducted for gold and silver, making 8.07c. per lb. as reported. But if this figure is to be compared with the Lake Superior costs let us look further into the figures reported. We find that the operating expenses as reported include $272,675 for "prepaid expense-ore stripping" but in addition to this item as charged to operation, there has been a further expenditure of $1,022,967.34 for stripping and an additional sum for improvements and equipment charged to property account of $822,170.58. Add these two amounts to the total operating expense as reported and we have a total of $9,664,614.82, which makes the total cost of copper 11.49c. per lb., and deducting 1.18c. for gold and silver leaves an actual cost of 10.31c. per lb. instead of 8.07c. as reported.

The 1911 annual report, just published, states that 93,514,419 lb. of copper were returned by the smelters from 4,680,801 tons of ore yielding about 20 lb. net per ton at a cost of $8,324,053 or 7.87c. per lb. after deducting 1.07c. for gold and silver credits. The operating cost reported includes $351,060 for stripping ore, but like 1910 there was an additional amount spent, $1,628,766, for the same item, but charged to deferred account. If we add this amount and $1,215,121, which was spent for improvements and equipment as charged to capital account, as well as $30,966 for interest paid but deducted from miscellaneous earnings, we have a total expenditure of $11,198,905.75 for the year. We then have a cost of 11.94c. per lb. and after deducting gold and silver credits, 10.87c. per lb. instead of 7.87c. as reported. It will be noticed in this report that $2,500,000 of the stripping expense which in the past had been charged to deferred accounts, was charged to profit and loss account this year. In this way this sum will never appear in the report as an operating cost where it belongs. It is plain to see that the claims of 8c. costs have not been actually realized at the Utah Copper and are nothing more than estimates of hopes for the future, and are obtained at present only by deferring to some future date charges that may or may not be charged off at present in the correct proportion to the tons of ore produced. The fact that such a sum has to be charged off through profit and loss certainly leads to the inference that it has been found necessary to allow more than has been charged through the operating cost statements.

In regard to construction and equipment expenses, it must be remembered that these charges are inevitable and will continue to be a large item as long at the property operates. For example, the Calumet & Hecla figures given above, show that it has cost this mine 0.74c. per lb. of copper or 7.86% of the total expenditures during the five-year period. In the case of the Utah Copper the amount charged to capital accounts for construction and equipment in 1910 was 8.5% of the total expenditures or 0.97c. per lb. of copper; anl in 1911, 10.8% of the total or 1.29c. per lb. of copper. The Calumet & Hecla current-construction

expense represents about the average of what it has cost all the Lake Superior mines for the same expense.

If we reconstruct the figures of the Utah Copper Co.'s report in this way the operating profits are materially different from those reported in the 1910 and 1911 annuals; $5,401,775 and $6,237,928 respectively. In 1910 the operating revenue was $11,710,389; deducting the total expenditures for mining, milling, transportation, construction, improvements and stripping as stated, $9,664,615, the net operating profits will be only $2,045,774. The revenue from investments, etc., amounted to $1,510,863, making a total net revenue of $3,556,637, out of which was paid a dividend of $4,648,676, a deficit of $1,092,038 for the year.

In 1911 the operating revenue was $12,825,953, from which deduct $11,198,906 for expenditures and the operating profit is $1,627,047. The income from investments, etc., amounted to $1,766,995, making a total net revenue of $3,394,042, out of which a dividend of $4,703,022 was paid, leaving a deficit of $1,308,980 for the year. This makes a total of $9,451,698 paid in dividends in the last two years out of a total net revenue of $6,950,679, or an excess of $2,501,018 over revenue. During 1911 the current assets were reduced $2,030,753. The figures stated do not include any investments made by the company in various enterprises. It should be perfectly plain to any one that these figures must be reconstructed in this way if they are to be compared with the copper mines of Lake Superior carrying no deferred charges. The stripping that has already been done will surely yield more ore than has been taken from the pits but it is a question whether the operation of the mine can be continued from year to year with a less amount of stripping. An important fact in connection with this question is, that to increase the tonnage production 7.84% in 1911 over 1910 it was necessary to increase the underground proportion 8%—from 18 to 26% of the total tonnage. If this means that any further increase in output will have to come largely from the underground workings it certainly does not argue that the cost of mining and stripping will be lowered.

HEATH STEELE.

New York, May 3, 1912.

Safety Appliances in Inclines

Referring to the closing paragraph of Claude T. Rice's letter, published in the JOURNAL of Apr. 27, 1912, I wish to state that the main shaft of the Burra Burra mine, of the Tennessee Copper Co., in the old village of Ducktown, Tenn., is a three-compartment shaft, sunk at an angle of 80° from the horizontal. In the hoisting compartments there are operated two 5-ton skips by means of a Nordberg first-motion, double-cone drum hoist. Between each skip and the hoisting rope there is interposed a Humble disengaging hook, in which, when overwinding occurs, a copper pin is sheared, the skip hangs up and the end of the rope with its corresponding connection is let free.

In the 10 years this hoist has been in operation, one overwinding has, to my knowledge, taken place, in which the device worked perfectly, and in an hour the skip was again in commission.

J. PARKE CHANNING.

Miami, Ariz., May 1, 1912.

As to Prospecting

In the JOURNAL of Apr. 6, 1912, there was an editorial with the above title, on which I wish to make a few remarks. There are few prospectors in the field now, not one where 10 to 20 years ago there were hundreds. It is an impossibility for a prospector to get a grubstake these days. Even if he finds something worthy of development, he cannot interest a mining man with capital, to assist him. The main reason appears to be the arbitrary action of the Government, and of some petty officers, in the rulings which drive the prospector off the forest reserves. The great majority of the mining men, now, will not even look at any thing that is not patented and developed, because they cannot get titles any more.

Judging from this district alone, there must be thousands of claims upon which receivers' receipt has been issued, and patent denied because of insufficient mineral showing on the surface. Here, in many cases it means a shaft 800 to 1200 ft. deep. The land itself is not worth 10c. per acre, growing a few scrub juniper and cedar trees and brush, a steer would starve on 100 acres.

If attempted today, the land office would refuse to patent the Nevada Consolidated Copper Co.'s properties, which are paying dividends on ore of less than 2% copper. It recently threw out a large gold ledge in California, averaging $4 to $5 on the surface, claiming it was not a commercial proposition. This is certainly not the intent of the mineral laws as construed up to recent years, and the worst is, there is no appeal from these unjust rulings of the Land Office. Canada, Mexico and South America all have better mining laws than the United States. It looks as though our Government was determined on driving us from home. No doubt there are many small areas in out-of-the-way places, that have not yet been thoroughly prospected; but it is problematic, whether there will ever be discovered other Leadvilles or Cripple Creeks, in the United States (not including Alaska).

The best chances for other good mines are in present known veins, that may prove profitable at depth with development. There are many dividend mines today that never paid until 150 to 300 ft. deep; the United Verde is an example of the latter. There are few cases similar to Butte, where more recent cross veins of silver proved up the deeper copper deposits.

As to Professor Newsom's remarks before the Metallurgical and Mining Society regarding Chilean nitrates, one must consider the climatic conditions there: An elevation of 3000 to 5000 ft., an absolutely barren waste, not a thing growing, no rainfall whatever, except once in 25 to 30 years, and the deposit covered 12 to 20 ft. deep with wash, clay and sand cemented together, impervious to water. Death Valley offers the nearest similar conditions, in our country.

The "Mineral Industry" and the State Engineer of California have both reported immense deposits of commercial nitrates there, but it is a mistake, as far as I know. There are nitrates there, yes; a deposit of an average thickness of 1 ft. or less, with an average content of 3½% nitrate of soda, distributed over a rough, broken, sandy country, miles in extent, eroded away in many places, in others covered deep, that will not pay even transportation to a central plant. The same can be said of the deposits on the Colorado River and also in Arizona. I have seen a deposit in Mexico, covered with eruptive rock, making it perfectly dry and preserving it. The Mexicans have extracted the nitrate and left a cave approximately 200 ft. deep, 100 ft. wide and 20 ft. high, the walls and floor of which are all of the same deposit; they made powder out of it. It shows from 3 to 14% of nitrate of soda.

As to finding potash at Searles Lake, San Bernardino County, Calif., while no doubt the Geological Survey's activity attracted their attention to it, the discovery was made by the owners, who had worked it years for its borax and soda values. At 600 ft. depth they encountered the potash. It is estimated that there are 15,000,000 tons, and that it can be put on the market at a good profit for 60% of the price of the German product.

For years their property has been on the market at a price of $250,000; recently they refused $5,000,000. Here at Railroad Valley, potash was known to exist 30 years ago. Salt was made here for the chloridizing of ores at Tybo, 45 miles distant, but it contained so much potash that it interfered with its use. The enterprise of a Tonopah company, which, after having its engineers examine many favorable localities, settled upon Railroad Valley as the best, looks as though it would be rewarded. The drill hole is now over 400 ft. deep, and the managers are well pleased with the results so far.

G. L. SHELDON.

Ely, Nev., Apr. 20, 1912.

Notes on the Design of Drill Bits

By Ward Blackburn*

Improved drill chucks permit changing bits so quickly that cutting rather than staying qualities are desired, except when transportation from shop to face is expensive. Machine sharpeners effect economy, even at small mines, because the accuracy of gage permits more efficient and rapid drilling.

*Mining engineer, care of Ingersoll-Rand Co., 11 Broadway, New York.

The efficiency of a rock-drilling plant is determined by the amount of power delivered to the bit and converted into cutting power. No matter how efficient the compressing plant and the rock drills, or how careful the drill operator, if the bit is dull or of incorrect shape, the rock is not cut, good energy is wasted, and money and time are lost in reaming the bore hole or in pulverizing the rock, and the real object of the work is defeated.

At most mines little attention is paid to the drill bits by anyone except the blacksmith. The drill runner is satisfied if the bits run out a change and hold gage well for the next bit to follow. The fewer changes, the better he likes it. The same is true of the blacksmith. The longer a bit is in service the less frequently must it be sharpened. The bit is designed for use as long as possible without resharpening and the cutting properties take second place.

Cutting More Important Than Staying Qualities

In designing a good bit both cutting and staying properties should be considered, but the day of hand-sharpening and of chuck bolts is rapidly passing, and now the efficiency sacrificed to staying properties is determined largely by the cost of transportation and handling of bits and permissible loss of gage. It is not influenced to the same extent as formerly by the labor of sharpening or trouble of changing bits. The cost of transportation and handling of bits amounts to a considerable item which increases as the lasting qualities of the bit are replaced by cutting qualities, so that it often governs the extent to which the design may be changed.

Light, compact mechanical sharpeners can now be obtained at a reasonable price, and as these machines reduce the cost of sharpening to a low figure and enable the blacksmith to make several hundred bits per day, shop considerations offer no serious reason for retaining merely staying qualities in the design of the bit. Nearly all rock drills can be provided with a wedge chuck, or some means of holding the bit behind chuck keys so that bits can be changed in a fraction of a minute. This largely overcomes the objection to short bits. In several mines the cost of transportation and handling of bits is greatly reduced by installing the power sharpener with oil or coke furnaces underground.

Allowable loss of gage is an imporant factor, for the greater the loss the larger must be the diameter of the shorter bits to insure a certain diameter of hole at a fixed depth. This larger diameter means a loss of power, so this point can never be lost sight of in determining the bit to be used. Operators who believe the gage should be retained irrespective of the amount of power used run the edges of the wings of the bit back about one inch in a line parallel to the axis, making the bit a reaming tool. If this is done, as soon as the cutting edges wear a little the shoulders begin to bind and stick against the sides of the hole, and it must be reamed out to a size which will allow the bit to move forward. When such a bit is removed from the hole it will show greater wear on the edges of the wings than on the cutting edges. As the bit is apparently as hard ½ in. back, as on the cutting edge it is reasonable to suppose that there has been as much work done in wearing the steel of the wings as in wearing an equal amount at the cutting edge, that is if the reaming edges show more wear than the cutting edges, it is to be supposed that they have done at least as much work as the latter. In other words, as much if not more power has been expended in reaming the hole as in cutting it; half the power has been used in cutting an area of say seven sq.in., that of a 3-in. circle, and half the power has been used in reaming an area of a little more than ½ sq.in., the area of the 1/16-in. rings reamed out. Furthermore, the rock drill is designed to cut rock by means of a blow. It is not a reaming machine, and as soon as a bit is cutting or reaming the side of the hole it is retarding the action of the drill. This strains the rotation and has a tendency to twist and break the bit. Power expended in reaming is power lost. From this it is apparent that because of the rapid loss of power and the wear and tear on the rock drill, little of the efficiency of the bit should be sacrificed to the reaming qualities.

It is sometimes claimed that unless the bit has reaming edges, the hole will become rifled. This was true to some extent when the bits were forged by hand, but it was due to the difficulty of getting each corner or wing equidistant from the center of the bit. With most power sharpeners this difficulty is removed, and with the correctly formed bits there is little trouble from rifling.

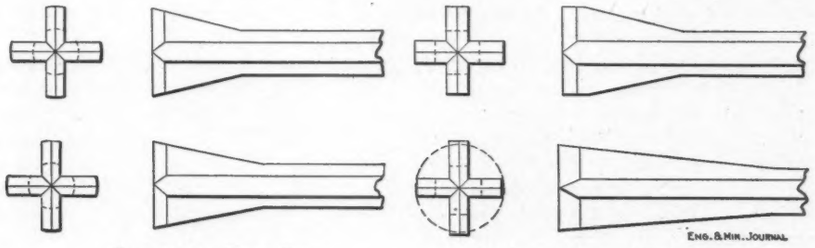
What Constitutes a Good Bit

While it is true that one bit cannot be selected as a standard for any and all classes of rock, still the power-sharpener manufacturers, especially those who have gone into the study of drill bits, are gradually working towards a few standard types. The consensus of opinion is that under average conditions a good bit for power-drilling work should embody the following points:

(1) It must take full advantage of the chipping and fracturing of the rock. In a bore hole there is a certain depth to which rock will fracture when struck by a sharp tool. If the tool is driven deeper than this it will not fracture the rock, it will crush it. If the cutting edge of the bit is blunt it will not get full advantage of the fracture, and considerable of the force will be expended in crushing or pulverizing. The bit acts as a wedge.

(2) The wings of the bits should be as thin as is consistent with standing-up quality to allow for the ejection of the cuttings. If the wings are left heavy there is little space for the escape of cuttings and consequently they are held in front of the bit and continually churned and ground, the bit does not easily reach solid rock and the blow loses a large proportion of its cutting power before it reaches the rock.

(3) The bit must be perfectly free in the hole at all times; because of the



Correctly Made Bits — Incorrectly Made Bits

tendency of the rock to fracture, the drill hole will be a trifle larger than the cutting edge. If the bit is so designed that the cutting edge is its greatest diameter and will practically remain so until dull it will always remain free in the hole.

(4) The bit must allow equal wear on all corners. If the bit is not symmetrical, that is if the ends of all the cutting edges are not the same distance from the center of the bit, the longest end will cut a groove in the side of the bore hole and a rifled hole will result. Furthermore, the wear is unequal and the extra strains in the steel often break it. The rotation of the drill is impeded and the parts subjected to excessive wear.

(5) The bit must be dressed in a manner consistent with the treatment of good steel. It must not be overheated, or worked while too hot. Light rapid blows should be used in forging. The bit must be tempered properly. The proper temper should be determined by experiment and rigidly adhered to. The bit should be allowed to cool thoroughly after forging and should then be reheated for tempering. It should never be sharpened and tempered on the same heat.

Bits Should Fracture the Rock

In Fig. 1, are shown bits designed to fill these requirements. An angle of about 90° for the cutting edge is generally accepted as the correct angle. If the angle is greater the bit has a tendency to crush rather than fracture the rock, and as a rule the bit cuts slowly. An angle less than 90° gives a bit which will cut fast, but it has a tendency to break off and wear rapidly. There is also a tendency for it to enter the rock, especially soft rock, past the point of fracture and expend energy in crushing or wedging out the rock. The "mudding" powers are greatly diminished. The thickness of the wings may range from ¾ in. on a large steel to ⅜ in. or even less on a stoper and hammer-drill bit. The wing must not be so thin that it breaks off, still, the less stock necessary the better the clearance for the cuttings.

The third point is probably the hardest to comply with. When the bits shown in Fig. 1 are first placed in the hole the cutting edge is the largest diameter, and as it may be safely assumed that the rock will fracture 1/16 in. beyond the bit, the latter must be free in the hole. The wings of the bit taper in the ratio of one to four, or one to five, and as the cutting edge wears a shoulder or reaming edge forms on the wing. When it wears between 1/16 and ⅛ in. from each wing a shoulder ¼ to ⅝ in. forms and there is a point between these where the cutting edge is fracturing the rock in the side of the hole to a diameter equal to the diameter of the bit through the shoulders. In other words, the shoulders of the bit are just touching the sides of the hole. If the bits run past this point, the cutting edge will not cut the hole to a diameter large enough to admit the bit and the shoulders immediately become reaming surfaces.

The taper of 1:4 or 1:5 is determined upon a medium. If less taper is used, say 1:7, the shoulders become more prominent and the cutting edge has less allowable wearing surface before the bit binds in the hole causing the shoulders to become reaming surfaces. If the wings have a greater taper, say 1:2, the wear is excessive, and the loss of gage prohibitive. The sharp taper leaves the ends of the cutting edge in a weakened condition and they easily break and chip off.

Machine Sharpeners Make Uniform Bits

The necessity for having the drill bit concentric is obvious. In hand sharpening and even with some power sharpeners it is not uncommon to find one of the ends of the cutting edges protruding 1/32 to 1/16 in. beyond the others. Some sharpener manufacturers have effectively overcome this difficulty by entirely inclosing the bit under a heavy pressure while it is being forged. When this is done there can be no question as to the corners falling within a circle.

The tempering and manner of heating and treating the bit is generally left to the discretion of the blacksmith. This is a mistake as a little attention and study given the subject by the manager or superintendent will often result in marked improvements. Many kinds of steel now on the market, and the scientific methods of treatment are entirely new to the average smith.

A word should be said about mechanical sharpeners. These machines have been greatly improved in the last few years, and now extremely light, simple designs of remarkably high capacity and efficiency are within the reach of all. The bits dressed in the sharpener are always perfect in form and gage and everything considered, will give from 25 to 50% greater efficiency than if sharpened by hand. In addition to the increased speed of drilling there is a noticeable saving in the wear and breakage of machine parts and the bit itself lasts longer and wears much better.

When installing a power sharpener one should not lose sight of its main advantage, increasing the efficiency of the drill bit. It should be installed with the idea that because of the marked reduction in the cost and time of sharpening one can afford to furnish the drill with better steel more often. It is impossible to make a hard and fast rule as to when a power machine should be installed, but it is certain that a sharpener will effect a material reduction in cost per steel dressed, lessen the machine repair parts required, save steel and steel breakage, and greatly increase the drilling speed of machines.

Great Falls Power Company

A recent report of John D. Ryan, president of the Great Falls Power Co., contains the following information concerning this company's affairs. The property of the company includes practically all of the land, all water rights and all available power sites on both sides of the Missouri River, extending from a point just below the city of Great Falls, Mont., for about 8 miles down the river. Within this distance the river makes a drop of over 400 ft. with a water flow of sufficient volume for the development of 76,000 continuous electrical horsepower at the lowest stage of the water, and without any benefit from storage reservoirs already in service. It is stated that with the amount of storage obtainable, at least 130,000 continuous horsepower can be developed.

At Rainbow Falls, the company completed in 1910 a modern hydro-electric plant, having a total capacity of 21,000 kw., in generators, and 36,000 horsepower in water wheels. The natural fall of the river here is about 80 ft., and the available head is increased to 105 ft. by a rock-filled crib dam 29 ft. high, and 1146 ft. long. The water is carried by steel pipes to a balancing reservoir above the power house. The power developed at this station is carried over two separate three-phase transmission lines to Butte, a distance of 135 miles and on a single three-phase line to Anaconda, 25 miles beyond, as well as to the smeltery and lighting plants at Great Falls. The company also owns a dam and power house at Black Eagle Falls, two miles above the Rainbow Falls development, having an available head of about 45 ft. where about 10,000 hp. is developed. All of this power is sold to consumers in the vicinity of the falls.

Referring to the issue of $5,000,000 bonds, dated May 1, 1911, Mr. Ryan says that this issue constitutes the only bonded debt of the company, and is secured by an absolute first mortgage on property valued at over $9,000,000. The sinking fund of 1% per annum on all bonds authenticated is estimated to be sufficient to retire nearly one-half of the issue before maturity. Earnings for 1911 were over 2½ times full annual interest charges on outstanding bonds. It is estimated that earnings for 1912 will be over three times the interest. The stability of earnings is assured by long-term contracts at profitable rates. The operating expenses are stated to be less than 20% of gross earnings. Additional bonds can be issued only under carefully guarded restrictions.

The Rio Tinto Company

At the recent annual meeting in London Chairman C. W. Fielding made the following statements which supplement the annual report: "Mining operations in Spain have been carried on as usual, and in the opencasts very good work has been done during the past year. The preparation for the mining of mineral in future years is being arranged for in proper sequence. You will no doubt remember, from what I have said on previous occasions, that we have to take a very long view in connection with such operations. Engineering programs for the different lodes are laid out for years to come, so that work may be done most economically over a period of years, and not in regard to the exigencies of any one year irrespective of the total economy of the whole operation. In the larger opencasts we have, this year for instance, to remove more than the due proportion of overburden actually required in connection with the year's operations, in order to make a considerable economy in the cost of getting out the mineral from the mass as a whole during subsequent years. . . The program that may ultimately be decided upon for this operation will in all probability introduce electric traction into one or more of our underground departments at a lower level than now worked by adits. It is not expected that any very heavy expenditure will be required, or that new capital will have to be raised for this purpose.

"I have nothing new to report to you this year in connection with methods of extracting copper from our ores, although gradual improvements are being developed in all the departments in which these operations are carried out, and further alterations and economies are being worked out experimentally on a commercial scale, with a view to still further cheapening the cost of the copper produced in Spain.

"I am glad to be able to give you a cheerful forecast as to the future of the sulphuric acid industry. As you know, we are deriving a large portion of our profits from the sale of pyrites and washed ores, which are used all over the world for the manufacture of acids. The demand for these is ever growing and during the last year our deliveries have again considerably increased. For consumption in the current year, we have already sold as much as we delivered in 1911. Of course, we make our sales with the proviso that deliveries need not be made if we are prevented from making them by causes beyond our control. The coal strike may have a bad effect upon our shipments because steamers are unable to get coal for their own propulsion, and consequently we cannot get as many boats to carry ore as we require. For our own consumption of coal, however, at the mines, we are fairly well situated, having accumulated before the strike broke out a stock that would last us for nearly three months."

Ray Consolidated Copper Co.

The report of the Ray Consolidated Copper Co., operating at Ray, Pinal County, and Hayden, Gila County, Ariz., for the 18 months ended Dec. 31, 1911, shows that the first section of the mill was put in operation about the middle of March, but that it was not run continuously until after Apr. 1. Another section was started in April, and three more sections have since been completed, although it has never been necessary to operate over four sections at a time, for the tonnage available. The total ore treated was 681,519 tons of an average grade of 1.83%, giving 15,721,520 lb. of copper, or an average extraction of 63.1%. However, during the last quarter of the year the extraction was 66.27%, and in February, 1912, the extraction was 70.32% on a 1.68% Cu ore. Costs were 10¾c. per lb. of copper, but these were about 1½c. higher than they should have been, because of the necessity of shipping concentrates to El Paso, instead of to the plant at Hayden. The concentrates carried 22.4% of copper.

Ore reserves are calculated at 64,700,000 tons of fully developed ore carrying 2.16% copper, and 12,600,000 tons of partially developed 2.23% ore. Fully developed ore is that marked out by drill holes in 200-ft. squares. Altogether 353 drill holes, aggregating 147,449 ft., have marked out ore on 183.4 acres. Commercial ore was cut by 277 holes. The average thickness of the overburden is 225 ft., and of the ore 101 feet.

Underground development on Jan. 1, 1912, amounted to 158,898 ft., or a little over 30 miles. Underground work, which is to be done by the shrinkage-stope system, is stated to have checked drill assays satisfactorily.

The mill is designed in eight sections of a nominal capacity of 1000 tons per day each, though actually higher.

Process for Separating Blende and Barite

By F. C. Bryant*

During the last 20 years or more, a constant effort has been made by the mine owners and operators of central Missouri to separate the blende ores from the associated barite, which invariably occurs throughout the central zinc belt. These ores are found in at least 10 of the counties in Missouri. When a successful means of separation shall have become generally known, this section of the state should produce a large amount of zinc.

It is the purpose of this article to describe a device in use at the Tahoma mine, in Benton County, which has given entire satisfaction, at this mine, but which strangely enough utterly failed at the Black Jack mine, in Cole County. The device has been tried out on ores from 20 different mines, and has been successful in all cases except at the Black Jack. There is something in the barite at the Black Jack that makes it impervious to the heat, or I should say, the barite contains some element that makes it proof against heat. At the Tahoma, the usual method of concentration with Cooley jigs is employed. The milling capacity is 400 tons per day. The concentrates are partially dried and then fed by gravity into the separator.

Tahoma Mill, Benton County, Missouri, Using Bryant Process for Separating Zinc and Barite

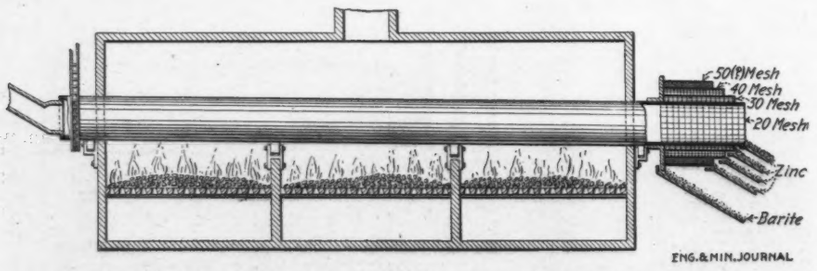
The separator is a device consisting of a tube 12 ft. long by 8 in. in diameter, set into a brick furnace, built for burning oil. The tube inclines slightly toward the discharge end. The tube is equipped with a loose ring hopper on the feed end, and with a series of screens, arranged concentrically, the coarser one on the inside. The first screen is of 20 mesh, the next one is 30 mesh and the outside 40 mesh. In some cases a finer screen may be used. At Tahoma, little of the zinc will break to pass through a 40-mesh screen; all the barite will readily

*General manager, Black Jack Mining Co., Bass, Mo.

pass the 40-mesh screen, in fact 90% of it will pass through a 200-mesh screen, as it comes from the tube. The accompanying engraving shows one of the first designs.

The later furnaces differ in that they are provided with oil burners; are fired at the lower or discharge end and have a target at about the center of the furnace and the stack at the feed end.

The concentrates, after being partially dried, are dumped into a hopper, from which they slide into the tube, the latter being run at 25 r.p.m. The concentrates gradually work down through the tube, and owing to the revolving motion they are carried up on the side and thoroughly exposed to the red-hot surface of the tube. The barite begins to explode or pop like popcorn the instant it comes in contact with the hot surface. This action also hastens the motion of the ore in the tube. As the decrepitated barite and blende come from the tube, they go on to the screens. The oversize from the 20- and 30-mesh screens goes into the bin; the oversize from the third screen



BRYANT APPARATUS FOR SEPARATING ZINC AND BARITE

is a middling product and is returned to the head end. The latter has an impure barite in it that usually goes down on the second run.

As stated above, 90% of the barite will pass a 200-mesh screen as it comes from the tube, and but 10% of the blende will pass a 40-mesh screen. What blende does pass with the barite through the 40-mesh screen is put into what is called a "plow arrastre." This is a concrete vat 10 ft. in diameter, having 8-in. walls provided with a frame into which are fitted 10-in. sections of 200-mesh screens. The arms of this arrastre have plows in place of weights, and are run at 25 r.p.m. During the operation, a stream of clean water is kept running into the arrastre until all the barite is washed out through the screen. The zinc is then drawn off and another charge put in. The barite cleaned in this manner is worth $5 per ton in St. Louis. This is sufficient to pay the cost of all the treatment. This is an inexpensive method, and has the advantage of making a byproduct of the barite, while other systems allow it to go to waste. The apparatus has been patented (U. S. pat. No. 631,951, F. C. Bryant).

Peruvian Mineral Production

BY EDUARDO HIGGINSON*

The accompanying figures for the mineral production of Peru are furnished by the director of the Institute of Mining Engineers, of Peru, at Lima, and are arranged in order of descending values of the 1910 productions.

PERUVIAN MINERAL PRODUCTION, 1909-1910

Substance	1909	1910
Copper, metric tons	20,068	27,375
Silver, fine, kg.	207,656	252,565
Crude petroleum, net tons	188,128	167,712
Vanadium ore, tons	1,749	3,130
Salt, tons	22,715	17,594
Coal, tons	321,502	307,320
Gold, kg.	554	708
Kerosene, tons	3,843	3,979
Boxax, tons	2,715	2,351
Bismuth, refined, kg.	30,300	24,136
Lead ore, tons	2,093	1,866
Tungsten ore, tons	.....	12
Antimony, fine, tons	20.1	48.7
Mercury, kg.	350	350

Utah Copper Co.

The report of the Utah Copper Co. for the first quarter of 1912 shows production of copper in concentrates as follows: January, 8,156,612 lb.; February, 8,612,739; March, 8,160,199; total 24,929,550 lb. Ore milled was 1,365,910 tons carrying 1.435% copper. The seventh remodeled section of the Arthur plant was placed in operation about the middle of January; the eighth, the last of February; and the ninth early in April. Total profits for the quarter are given as $1,797,652; dividends paid, $1,181,288; there was an addition of $616,364 to surplus.

Norway Mining in 1909

The statistics of Norwegian mineral production for 1909 have recently been issued. The principal items are as follows:

Pyrites, 282,606 metric tons, 1867 laborers employed, value, $1,637,480; copper ore, 42,612 tons, 2243 laborers, $450,240; silver ore, 2729 tons, 1566 laborers, $150,080; feldspar, 36,439 tons, $127,568; iron ore, 40,389 tons, $79,260; nickel ore, 5770 tons; apatite, 1364 tons; zinc and lead ore, 983; arsenical pyrites, 160; molybdenite, 30 metric tons.

Fine copper produced amounted to 1594.48 metric tons; fine silver to 7780 kg., and nickel to 110 metric tons.

*Peruvian Consul General, New York.

Proposed Mining Legislation

WASHINGTON CORRESPONDENCE

The House of Representatives, on May 1, passed a bill to modify certain mining laws of Alaska, the salient sections of which are as follows:

No association placer-mining claim shall hereafter be located in Alaska in excess of 40 acres, and on every placer-mining claim hereafter located in Alaska, and until a patent has been issued therefor, not less than $100 worth of labor shall be performed or improvements made during each year, including the year of location, for every 20 acres or excess fraction thereof.

No person shall hereafter locate any placer-mining claim in Alaska as attorney for another unless duly authorized by a power of attorney in writing, duly acknowledged and recorded in any recorder's office in the judicial division where the location is made. Any person so authorized may locate placer-mining claims for not more than two individuals or one association under such power of attorney, but no such agent shall be permitted to locate more than two such claims for any one principal or association during any calendar month.

No person shall hereafter locate, or cause to be located, for himself more than two placer-mining claims in any calendar month: Provided, that one or both of such locations may be included in an association claim.

CHANGES IN MINT LAW

In reporting the new Legislative, Executive and Judicial Appropriation bill, the House Appropriations Committee has taken important action affecting mints and assay offices by including the following provision:

All laws or parts of laws authorizing the establishment of coinage mints at San Francisco, Calif.; New Orleans, La., and Carson, Nev.; and assay offices at Boise, Idaho; Charlotte, N. C.; Deadwood, S. D.; Helena, Mont.; Seattle, Wash., and Salt Lake, Utah, are repealed, to take effect July 1, 1912; but nothing herein shall be construed as abolishing or prohibiting the maintenance of an assay office at San Francisco.

The position of coiner, which has heretofore existed in each of the coinage mints, and the position of melter and refiner, which has heretofore existed in each of the coinage mints and in the United States assay office at New York, are hereby abolished, to take effect on July 1, 1912, and after that date the duties and responsibilities heretofore imposed by law on the officers holding said positions in each of said mints and the assay office shall devolve upon the superintendents of said institutions; and all assistants and employees of the mint and assay offices of the United States shall, from and after July 1, 1912, be appointed by the Secretary of the Treasury.

Turkish Mineral Production

The Turkish statistics for their year 1324, covering the period from Mar. 14, 1908, to Mar. 13, 1909, has just been issued. These show: Bituminous coal, 675,757 metric tons; lignite, 26,965; pyrites, 78,641; chrome ore, 11,547; manganese ore, 7578; iron ore, 8697 tons.

Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

Triangular Timbering in Tonopah-Belmont Mine

The Belmont vein which is being mined by the Tonopah-Belmont Development Co., at Tonopah, Nev., dips steeply and would seem to afford opportunity for using one of the methods of stoping without timbers; in fact, a modification of the shrinkage system has been considered for use in certain parts of the mine. However, because of the scaling of the hanging wall and because horses of rock exist in the vein it has been impracticable to use this cheaper system of mining.

The first stopes opened in the vein were from 10 to 16 ft. wide and stull timbering was used, but the weight of the hanging wall was so great that serious difficulties were experienced in holding the stopes open until they could be filled with waste. It was therefore necessary to resort to the use of the square sets shown in the accompanying illustration. As the exploitation of the wider stopes, which range from 15 to 45 ft. wide, proceeded it was found that even the heavy square sets were insufficient and that only prompt filling of the timbered stopes would hold them open.

In an attempt to reduce timbering costs the system of triangular sets was adopted, probably for the first time in an American mine. These sets, as shown in the accompanying illustration, consist of the usual caps and girts of the square-set system, but instead of posts inclined braces are used so that in effect the completed structure becomes a series of adjacent isosceles triangles. This system was described at length by A. J. Moore in the JOURNAL of Sept. 16, 1911. It is claimed that the triangular sets by virtue of the inclined posts offer more resistance to deformation than the square sets.

It is stated that at the Belmont mine the triangular sets require 10% less timber than square sets, but the greatest economy from their use is expected to be derived from the increase in strength which, it is hoped, will overcome to some degree the necessity of immediately filling the timbered stopes with waste. The waste filling has, with square sets, become expensive at times as the quantity of waste available has often been inadequate and had to be procured by driving raises or crosscuts in the walls.

The framing of the great quantity of timber used is economically done by a timber-framing machine and by saws especially arranged for the work.

SQUARE AND TRIANGULAR SETS IN TONOPAH-BELMONT STOPES

Bending Sand-Filled Pipe

The loss of pressure in steam, air, and water lines caused by using sharp bends or elbows is now receiving more attention than formerly. It is the uptodate practice to use as few elbows as possible and to use instead bends of as large radius as is economical, even for small pipes.

It takes time and patience to bend the larger sizes of pipe, and usually a better bend is obtained by using many short heats. It is not easy to obtain smooth bends, especially with small pipes. There is a tendency to hasten the work with the result that the pipe is flattened on the inside of the bend. This flattening can be avoided by ramming the pipe full of dry sand or flue dust before heating and bending. Dry sand should be used; otherwise the pipe may burst from the pressure of the steam derived from the moist sand when the pipe is placed in the forge.

Tempering Drill Steel—I

BY CLARENCE C. SEMPLE

The aim of the drill maker is to produce a tough bit the edge of which, while not hard enough to be cracked, will hold its gage and shape until the hole has been drilled to a depth approximately equal to the length of feed of the machine. It is not always possible to produce such a bit for drilling very hard rock, and, in such cases, the drill sharpener is called upon to use his best judgment in the compromise between hardness and toughness. The cutting edge of the bit is the only part that must be hard and the degree of this hardness and thickness of the hardened layer are within the control of the smith. Too thick a layer of hardened steel would result in cracking of the edge while in use.

The operation of giving the bit the requisite hardness is known as tempering. It is the final heat treatment that the bit undergoes before it is ready for use, and this operation consists in making the entire end of the bit as hard as possible, then softening it the desired amount.

Steel may be hardened by sudden cooling after heating it above its critical temperature, a temperature which is different for steels of different composition; for ordinary tool and drill steel

bright-red heat. Steel heated to or above its critical temperature is not magnetic and this fact may be used as a method of determining the critical heat; the hot end of a bar will not affect the compass needle if the temperature is at or above the critical temperature. Certain molecular changes take place at the critical temperature, the nature of which it is not necessary to discuss in this article. Heating the steel to even a few degrees below the critical temperature will not produce the change, neither will heating the steel much beyond a few degrees above the critical temperature have any effect upon the hardness. Too high a heat will only tend to produce coarse-grained steel—not a desirable quality.

The degree of hardness depends upon the rate or speed of cooling the steel after it has been heated above its critical temperature. If the steel is cooled slowly, taking several days, it will be as soft as it is possible to make it. On the other hand if the steel be quenched suddenly from its critical temperature by plunging into cold and good conductors of heat, such as ice water, ice cold brine, sulphuric acid or cold mercury, it will have the greatest possible hardness. In hardening steel the plunging should be done on an ascending, not on a descending heat. That is, with a steel the critical temperature of which is 1465° F., the plunging should be done as the temperature rises say from 1470° to 1475°; it should not be heated say to 1500° or more, then be removed from the forge and held until the temperature drops to 1470° before plunging.

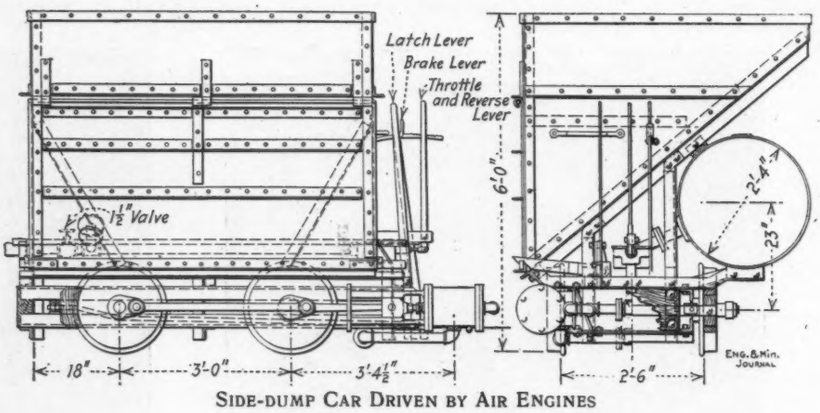
If steel, so hardened by quenching, be placed in a liquid of low boiling point for several days it will be slightly softened; by using liquids of higher boiling temperatures a greater degree of softening of the hardened steel will ensue. The degree of softening is also a function of the time of immersion, for a piece of hardened steel left in a liquid of low boiling point for a sufficient length of time can be softened to the same degree as if it had been placed for a shorter time in a liquid of higher boiling point. The steel must not, however, be heated above its critical temperature. It makes no difference in the hardness whether the steel is quenched suddenly or allowed to cool slowly when taken from the hot softening solution, but slow cooling may impart greater toughness.

The operation of softening after hardening is called tempering and restores some of the toughness to the steel and reduces its degree of hardness. Drill bits could be tempered by standing in a hot liquid after the hardening operation. A liquid, such as hot oil that boils at 500° F. or a molten alloy of two parts lead and one part tin, which melts at 440° F., and which should be maintained at a temperature of 460° to 500°, could be selected, which would sufficiently temper the bits without reducing the hardness to too great a degree, but such tempering takes place from the outside inward so that by such treatment the hardened external layer might be softened to a greater degree and more quickly than the interior. This is just the opposite of what is required in a drill bit. Tempering by heating in liquids is rarely used in preparing bits for drilling in rock.

Air Driven Side Dump Car

By S. A. Worcester*

The car illustrated in the accompanying drawing was designed by me for use at a mine in which electricity cannot be conveniently used for this work, but air at 100 lb. pressure is available in the mine. The car has to make a maximum trip of 300 ft. loaded and return empty. A 28x72-in. air receiver is mounted on the car frame and is automatically recharged after each trip while at the loading station. A brass male coupling on the car which is connected to the receiver, enters a corresponding female stationary coupling as the car strikes the bumper at the loading station. When the couplings are brought together the stems of two check valves encounter each other and both are opened, thus admitting air from the stationary air line to which the female coupling is attached, to the receiver on the car. When the car starts away, separating the couplings, the pressure instantly closes the check valves, thus preventing any loss of air.



Side-dump Car Driven by Air Engines

The engines are of simple construction and are made so that as few adjustments as possible are necessary, for they are used by unskilled operators. The construction of the car is inexpensive, the number of parts being few and the same pattern being used for both engines with but few and slight changes. The engines are reversed and controlled by a single throttle and reversing slide-valve in front of the operator and exactly similar to the slide-valves of the engines. Moving the lever controlling this valve in either direction starts the car in the corresponding direction and placing it vertically shuts off air from the engine.

The axle bearings and rod bushings are made of cast iron and are of the simplest construction. The crossheads are made of cast iron turned to fit the guides, and are equipped with straight pins. The cylinders are cast in one piece with the valve chests and front heads. The pistons are riveted to the piston rods which are screwed into the crossheads. Plain snap rings are used for piston packing. The eccentrics are cast on the drive wheels and eccentric straps and rods are forged in one piece and valve stems are made without any adjustment for length, so that when set they cannot be moved out of adjustment by unskilled operators. The brake has ample leverage and few parts. It is equipped with a pawl or latch which is used for holding the car in place against the pressure at the air coupling, which is sufficient to push the empty car away if the brake is not set. The car door latches are lifted by the lever at the left of the operator and all three operating levers are nearly vertical and close together, making a convenient and safe arrangement. The speed of this car, unlike that of most electric-motor cars, is almost unlimited, the 7x7-in. cylinders giving ample power. The air consumption is small.

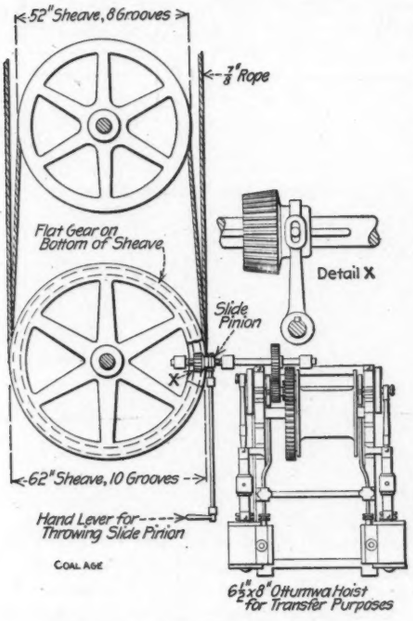
*Mechanical engineer, Victor, Colo.

At the Butte plant of the Anaconda Copper Co., four hoists are being operated by the compressed-air system and six more are being erected. These last are designed for hoisting a balanced load of six tons or an unbalanced load of 17 tons from an ultimate depth of 3500 ft. Twelve additional hoists are being built, each of which is designed to hoist a balanced load of two tons or an unbalanced load of 8½ tons from an ultimate depth of 3500 feet.

Gravity Plane with Auxiliary Hoist

A number of mines in the Roslyn district in the state of Washington are situated in the hills at some height above the tipples and railroad tracks states Joseph Daniels in *Coal Age*. The coal is usually sent down to the tipples by an engine, or gravity plane. At the No. 2 mine of the Roslyn Fuel Co. the gravity plane is 3400 ft. long, with an average grade of 14½%, and crosses three ravines on timber trestles. From the mouth of the mine tunnel, the plane has three rails to the midway point. The pass-by here is 120 ft. long and below this point a single track runs to the tipple. The track gage is 30 inches.

Cars are handled in trips of 10. The weight of an empty car is 825 to 850 lb.; the weight of the average loaded car is 2400 lb.; the size of the rope is



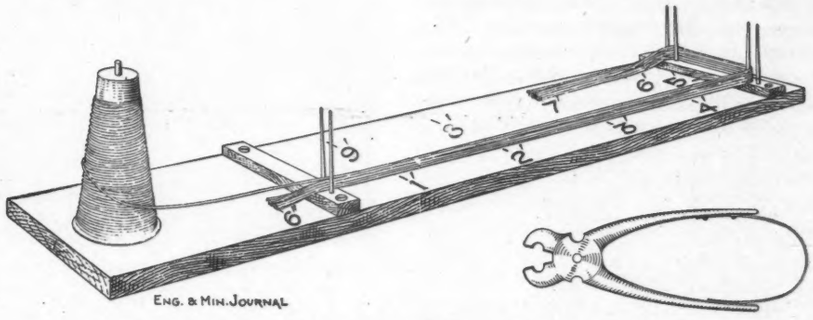
GRAVITY SHEAVE AND HOIST

⅞ in.; and the time required to hoist or lower a trip is 2½ min. A set of gravity-plane sheaves is used to lower the cars to the tipple, but the usual arrangement has been modified, as shown in the accompanying illustration. A gear wheel is fastened to the under side of the larger sheave. This gear meshes with a small pinion, mounted on a shaft, which is driven from the main gear of the hoisting engine, as shown in the sketch. The small beveled pinion is thrown in or out of mesh by being moved back and forth along the shaft, under the control of a hand lever, situated conveniently near the throttle and operating levers of the hoisting engine. This latter is a small second-motion, friction-clutch, single-drum engine, used for transfer purposes at the mouth of the tunnel.

The purpose of this arrangement is to enable the sheave to be driven when occasion demands; that is, if, for any reason, it is necessary to hoist the empty cars from the tipple to the tunnel mouth and there are no loaded cars available for sending down, the engine is started up and by throwing the pinion in mesh with the large gear, the sheave of the gravity arrangement is made to act as a drum for hoisting purposes. The device is also useful in case of breakdowns and derailments at any point along the road, when it may be used for putting the cars on the track, hoisting ditched cars out of the ravine and in many like contingencies.

Table for Cutting Fuse

The accompanying drawing shows the design of a table for conveniently cutting fuse. It is used at the Blackberry and Montana mines, near Joplin, Mo. The coil of fuse is carried on a conical spindle at the end of the table, and from this spindle the fuse is unwound as it is measured. The fuse is held between a series of two 60-d. nails driven into two cleats of 1x2-in. wood that are screwed to the table. The cutting is done six inches ahead of the first pair of nails, so that there are no long, loose ends in the way. On the table are marks which are used in measuring the several lengths of fuse usually required.



FUSE TABLE AND CAP CRIMPER USED IN JOPLIN DISTRICT

In cutting the fuse, the loose end from the coil is run through the first pair of nails, taken around the turning nails, passed through the last pair of nails that hold the loose end when the fuse is being cut, and the end is pulled along to the mark indicating the length desired. Then with the fuse cutters the fuse is cut off at the other end, and another piece of fuse measured until all the fuses have been cut, the different pieces being left securely held between the nails until the miner is ready to cap them. To aid in the cutting, the fuse cutters, which are ordinary crimpers, are made with a spring riveted to one of the handles, so as to keep the jaws apart. This increases the speed of cutting the fuse somewhat, and makes the use of the crimpers more convenient.

Tramway Tower in Path of Snowslide

BY WARREN C. PROSSER*

The aërial tramway of the Sunnyside mines in San Juan County, Colorado, passes along a steep hill slope which can hardly be avoided, and each year the tower that must be situated here, is carried away by a snowslide. It is known as the Johnson tower and is built on a foundation of heavy cribbing securely anchored to bed rock.

Above the base of the foundation a tunnel has been driven into a cliff for a distance of 50 ft. and in it a complete tower, knocked down, is stored at all times. When the Johnson tower is carried away by the snowslide that occurs but once each year, the reserve tower is taken from the tunnel and erected at the site of the one carried away. Another reserve tower is then ordered to replace the one taken from the tunnel. It takes but a few hours to erect the reserve tower on the old foundation.

Blasting in the Laramie Tunnel

In driving the Laramie tunnel in Colorado the average depth of hole was 17½ ft.; a stick of 60% powder was placed in the bottom of the hole; then the primer, on top of which five sticks of powder were used except in the case of cut holes, each of which were loaded with three or four extra sticks. The three lifters were loaded to the collars in order that the broken ground should be thrown as far as possible from the face.

Soapy Water for Compressor Lubrication

Soapy water for compressor lubrication continues to be advocated by J. Broad Roberts (*Journ.* So. Af. Inst. Engr., Jan., 1912) as a means of keeping mine air pure. Contamination with decomposition and volatilization products of lubricating oil is thus avoided.

*Mining engineer, Silverton, Colo.

Electric Mine Pumps in California

By L. H. Eddy

A new Deane of Holyoke 5x12-in. horizontal, double-acting, triplex, electrically driven pump was recently put in operation on the 2000-ft. level of the South Eureka mine in Amador County, California.

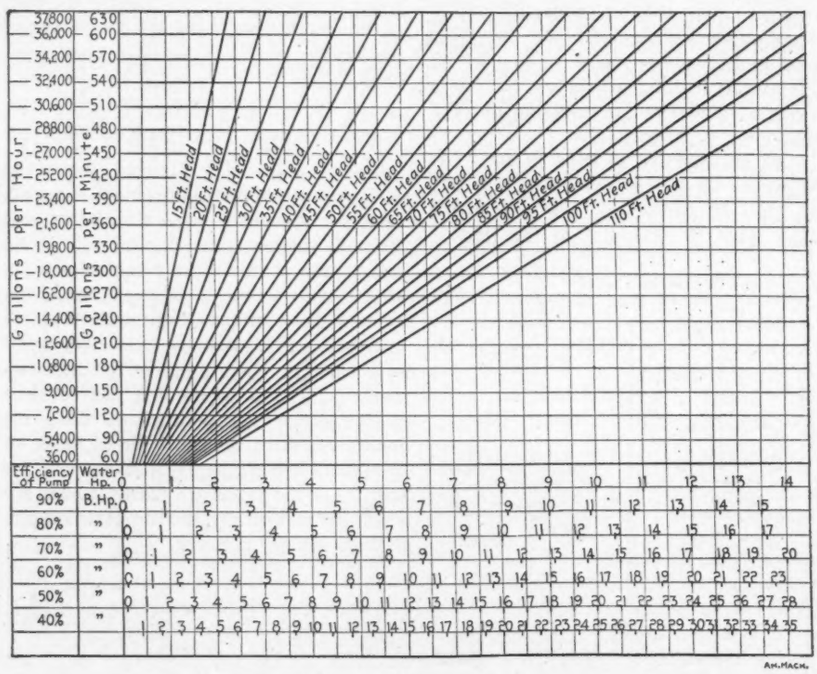
This pump is driven by a 150-hp. Westinghouse, 3-phase, 440-volt, induction motor. It has a capacity of 225 gal. per min., pumping the water to the surface or against a working pressure of 850 lb. per sq.in. As an auxiliary, a Dow 4x16-in. horizontal, double-acting, triplex, electrically-driven pump is installed on this level. This pump is driven by a 150-hp., Westinghouse motor and has a capacity of 200 gal. per min. against 850 lb. pressure. Only one pump is operated at a time, the other being always in readiness in case of breakage; the motors run at the same speed and are interchangeable, thus giving almost unfailing pumping facilities.

The pumps are installed in a room or station 25x50x12 ft., excavated in solid rock. There is also a Deane of Holyoke pump on the 2730-ft. level which pumps the water to the larger pumps on the 2000-ft. level. This is a 5x8-in. vertical single-acting triplex pump with a capacity of 90 gal. per min. against a pressure of 325 lb. per sq.in. This pump is chain-driven by a 30-hp., Westinghouse, 3-phase, 440-volt, induction motor. The electric current for these pump motors is carried down from the surface through a 300,000-circ. mils, lead-covered, steel-armored, 3-conductor cable at 440 volts.

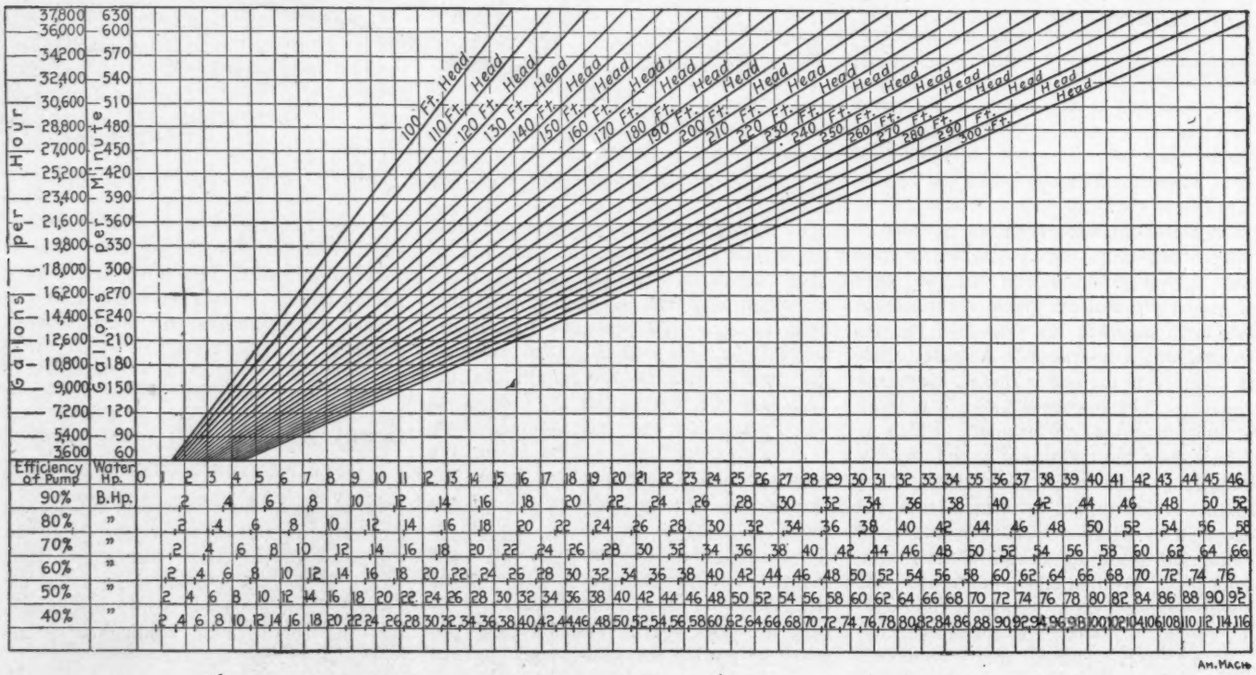
Pumping Diagrams

The power required to pump a given quantity of water to a given height, when the efficiency of the pump is known, or how much water can be raised to a given height by the power available can be determined from the accompanying diagrams which were prepared by W. E. Wort for the *American Machinist*. These diagrams give the brake horsepower, number of U. S. gallons per minute and per hour, the pump efficiencies, and various heads in feet from 15 to 300 feet.

For example, if it be required to pump 350 gal. per min. against a total head of 85 ft. and the efficiency of the pump is 60%, the brake horsepower is found by following the 350-gal. horizontal line to its intersection with the 85-ft. head diagonal, then following down the vertical line to its intersection with the 60% efficiency horizontal line at the lower part of the table. It will be seen that 15 b.-hp. is the power required for the duty specified.



Pumping Diagram, 15- to 110-ft. Head (U. S. Gallons)



Pumping Diagram, 100- to 300-ft. Head (U. S. Gallons)

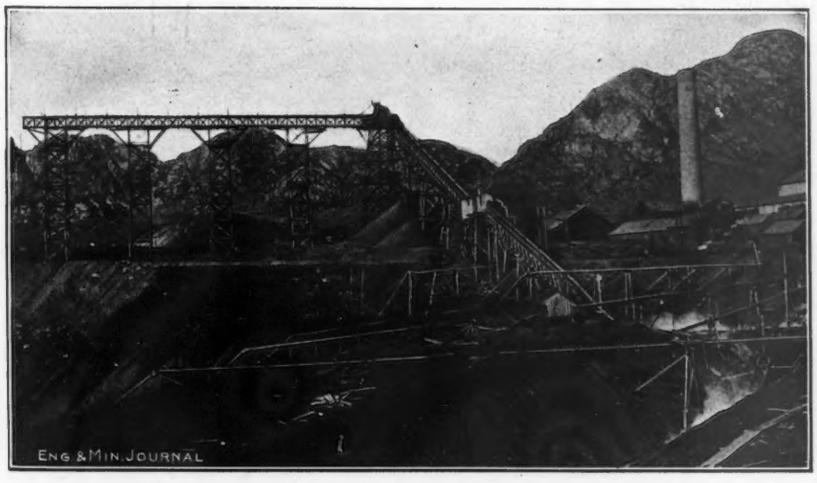
Details of Metallurgical Practice

Records of Experience in Ore Dressing, Cyaniding and Smelting

Slag Disposal at Granby Smeltery*

By Colby M. Avery†

At the smeltery of the Granby Consolidated, Mining, Smelting & Power Co., at Grand Forks, B. C., all slag until recently was disposed of by being transported in 6-ton slag pots drawn by dinky engines to a slag dump. This method of slag disposal had to be abandoned because all the available space for a dump had been taken up, and it was no longer possible to dispose of the slag in a molten condition because the highest level accessible to the cars had been reached. It was therefore decided to granulate the slag, elevate it after having been dewatered, and build up the granulated material on the old dump.



Conveyors for Granulatfd Slag at Granby Smeltery

The slag is granulated by being discharged into a stream of water by which it is carried in a flume to a four-compartment bin where the slag is allowed to settle and the water is drained off. From suitably arranged gates the material in the various compartments is drawn out upon a 24-in. belt conveyor which is supported by the trestle shown at the right in the accompanying halftone, and which leads up the incline to the horizontal conveyor operating on the high trestle shown in the center. This trestle is supported on the original slag dump and is 120 ft. above it. An automatic tripper on this conveyor distributes the slag over the ground below on each side. The pile will be allowed to rise 120 ft. or to the level of the distributing conveyor. When it has reached this level the buried truss will be abandoned and the conveyor framework will be moved sideways on skids to the edge of the pile. From this position the tripper will distribute the slag until the pile has again reached the limiting height. The conveyor will then be moved sideways a second time and the pile will be advanced this way until the entire area is covered to the depth of 120 ft. The moving of this long conveyor will be effected by long skids and jackscrews fitted with levers and ratchets set at frequent intervals.

The great height to which the slag has to be piled and the vast storage capacity that has to be provided called for conveyors of considerable length and of interesting design. The total length of the incline or No. 1 conveyor necessary to reach the elevation of 120 ft. is 645 ft. In order to reduce the strain on the belt this conveyor was made in two sections of about 324 ft. each with one section delivering upon the other midway up the incline.

Under the present conditions No. 1 conveyor discharges directly to No. 3 conveyor, the horizontal conveyor on the elevated structure. When the pile reaches this conveyor, however, and it will be necessary to move it sideways, No. 2 conveyor will be used. This conveyor telescopes beneath No. 1 conveyor and allows for lateral motion of No. 3. conveyor. As No. 3 is moved out, No. 2 will be moved up and outward so that when No. 3 has been moved to its final position, No. 2 conveyor will be horizontal, delivering from No. 1 to No. 3. The length of No. 2 conveyor is 500 ft. and of No. 3, 600 ft., which will be the limiting dimensions of the top of the pile when completed.

The supporting framework of No. 3 conveyor is connected rigidly to that of the tail end of No. 2 conveyor, and in this connecting framework is supported the motor which drives the two conveyors and the chute which delivers from No. 2 to No. 3 conveyor. All conveyors in this system are driven from electric motors through geared drives; 24-in. special belts are used, equipped at the delivery ends with automatic brushes. This method of disposing of waste slag is said to be no more expensive than was the former method of dumping the molten slag from slag pots.

*Excerpt from the Labor Saver.

†Manager, mines and smelter department, Stephens-Adamson Manufacturing Co., Aurora, Ill.

Winch Head for Lifting Mill Machinery

A convenient device for raising heavy objects in mills to a greater height than can be attained by chain blocks is a two-piece winch head. The two pieces are symmetrical and are of the same shape as would be obtained by splitting the familiar winch head usually found on most derrick hoisting engines through the long axis of the bore, except that at the ends of the castings there are flanges or lugs bored with holes to take the bolts that hold the two pieces together.

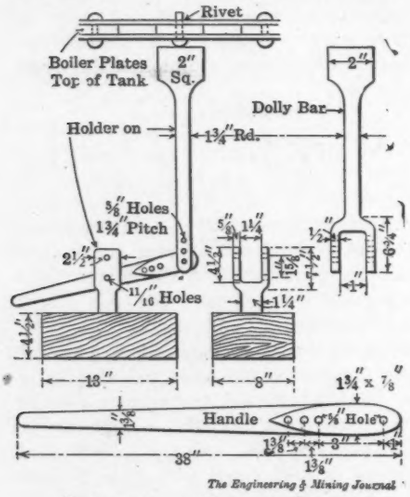
To use the winch head the two parts are disconnected; then each half is placed on opposite sides of line shaft in the mill; the four bolts are placed in the holes in the lugs and the nuts are tightened, bringing the two parts close together and making in effect an ordinary winch head on the mill shaft. The object of making the winch head in two pieces is, of course, to permit using it on any part of the shaft. The hub part of the casting projects beyond the ends of the winch barrel and in these hubs holes are tapped and threaded for setscrews which are used to hold the winch head securely on the shaft. A pulley is then hung in the mill rafters above the place to which the object is to be raised. A rope is threaded through the pulley and one end is attached to the object to be elevated; the other end is then pulled taut and four or five turns are taken around the winch head. The engine is then started and the mill shaft turned

slowly, and as the object is raised the operator pulls in the rope paid off from the winch head.

The idea of a split winch head was originated by J. A. Rogers, of Joplin, Mo. The device is used in the mills of that district especially for raising elevator belts over the top pulley, which elevators are 60 ft. high in some mills. Of course, this work can only be done when the mill is not in operation. The objection to the device is that it necessitates turning all the shafts and pulleys that are driven from the main shaft. The winch head should be placed on the shaft close to a bearing if a heavy object is to be lifted, otherwise there would be danger of bending the shaft.

A Handy Riveting Dolly

With the increased use of steel tanks and flues around the larger metallurgical works, riveting jobs have multiplied proportionately. The accompanying illustration from *Shop Notes Quarterly* shows



DETAILS OF A RIVETING DOLLY

the construction of a useful riveting device. This dolly can be used where a great many rivets have to be held overhead and close to the sides where it is hard to hold a dolly bar. By placing the rivet and then applying the dolly-bar end and holding down on the lever, the rivet may be upset without any strain on the man inside.

This appliance can be operated by a rivet boy where it would call for a man by the usual dolly-bar method.

Increase of Available Cyanide After Alum Clarification

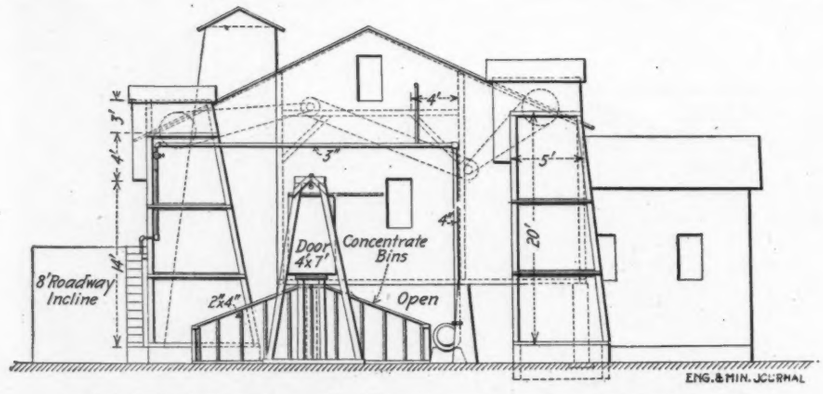
In the JOURNAL of Apr. 13, 1912, Chester Steinem described some experiments in clarifying cyanide solutions by the use of aluminum alum, carried on at Mogollon, N. M. In a recent letter, he writes that H. W. Miller tested several samples of solutions, the results showing an increase of 9 to 12% of available cyanide after the treatment with alum.

Bin for Concentrate

All mills in the Joplin district are built on flat sites and with the floors from 7 to 10 ft. above the ground. Instead of elevating into bins it has been found cheaper to shovel the concentrates from the boxes into a side-dumping car, which is run out on a trestle and dumped into bins with open ends. These bins are stalls rather than bins. Leaving the end wall out is typical, for it makes the shoveling of the concentrates into the wagons easier. If there were an outer wall, it would be necessary, when loading the concentrates, for the shoveler to work from the top of the pile down until the floor was reached.

In some mills the table concentrates are kept separate from the jig concentrates; in others the different table products are mixed with the different jig products. The practice depends upon whether the smelter usually buying the ore penalizes for fineness, and also whether the sludge concentrates are of such a nature as to be penalized. Generally there are three or four stalls or compartments on each side of the middle dividing wall, and each side is a duplicate of the other. The tracks for the car are carried on bents independent of the ore bin. All supplies are taken into the mill over this trestle. Consequently, it is surmounted at the end by a frame, from which a chain block can be swung to aid in lifting the heavier supplies, such as roll shells, out of the wagons.

The accompanying drawing shows a custom mill; there are many of these in the Joplin district. Generally the price for treating ore in a custom mill is $1 per ton for hauling and milling. Of course, the wagon haul must be short. When the wagon haul would compel a much higher charge for treatment, hand jigging would probably be cheaper, provided that the ore is at all adapted to hand jigging, as a favorable ore can be hand jigged for about 75c. per ton. The general type of custom mill is shown, in which the ore is hauled up on a platform in wagons, dumped and then shoveled into the crusher. It is owing to this fact that the mill is built only 6 ft. above the ground.



TYPICAL JOPLIN MILL, SHOWING POSITION OF CONCENTRATE BINS

Sleeves for Worn Elevator Pulley Shafts

As illustrated in the sketches accompanying the article "Take Up Device for Elevator Belts," p. 787, JOURNAL of Apr. 20, 1912, the shaft of the lower pulley of the bucket elevators used for raising wet material in the mills at Joplin, Mo., is carried in recesses in the end of two pieces of timber that slide within guides. As this shaft is often submerged in the wet pulp in the boot of the elevator, and as no protection from grit entering the recesses in the end of the timbers is provided, the ends of the shaft become grooved and corrugated.

To permit further use of a corrugated shaft, J. A. Rogers, a Joplin manufacturer of mining machinery, has placed cast-iron trunnion sleeves on the local market; they are not patented. The sleeve is a simple hollow cylinder 6¾ in. long and 4½ in. in diameter, through which is a bore 2 15/16 in. in diameter. A flange, 10 in. in diameter and ¾ in. thick is cast, integral with the cylinder, and 2 in. from one end, so that the part of the cylinder projecting beyond the flange on one side is 2 in. long and on the other side 4 in. Two holes are tapped in the shorter projection for ¾-in. setscrews. The external surface of the longer projection and the face of the flange on the side of that projection are machine finished.

One of these sleeves is slipped over each end of a corrugated shaft, the longer projection toward the end, which brings the shorter projection over a part of the shaft that has not been abraded, thus affording a firm bearing for the setscrews, by tightening which the sleeve is firmly held to the shaft. The longer projection goes into the recesses in the timbers and thus, for all practical purposes, a shaft as good as new is obtained. The flange acts as a set collar, or guide, and also tends to keep grit from entering the recess.

The Cost of Doing Things

Data from Mining and Metallurgical Practice

Tonopah-Belmont Mining Costs

According to the report of the Tonopah-Belmont Development Co. for the year ended Feb. 29, 1912, the total ore and waste mined was 188,988 wet tons. Of this 152,599 tons was crude ore from which 33,624 tons of waste was sorted and 115,563 tons of dry sorted ore was produced.

The costs per dry, sorted ton were: For development, miners, 47.4c.; muckers and trammers, 22.2c.; timbermen and helpers 8.4c., a total expense for direct development of 78c. per ton. The stoping costs were: Miners, 44.5c.; shovelers, 33.9c.; trammers, 19.2c.; timbermen and helpers, 97.8c.; filling, 4.2c.; piston-drill repairs and maintenance, 5c.; stoping-drill repairs and maintenance, 2.9c.; steel and sharpening, 7.1c.; explosives, 28.6c.; hoisting to surface, 30.9c.; auxiliary hoisting, 9.4c.; ore sorting and loading, 27.3c.; sampling and assaying, 4.7c.; surveying, 5.6c.; superintendent and shift bosses, 13.7c.; mine office, 12.9c.; surface and plant, 16.2c.; lighting, 4.6c.; heating, 4.1c.; drayage, 6.1c.; maintenance and repairs to buildings, 2.5c.; maintenance and repairs to machines and machine tools, 2.3c.; maintenance and repairs to pipe lines and tanks, 1.6c.; maintenance and repairs of railroad spurs, 0.8c.; maintenance and repairs to pole lines, 0.2c.; pumping, 6.2c.; ventilation, 1.7c.; or a total direct cost for mining, including development, of $4.72 per ton.

The total indirect cost, including administration, taxes and insurance, legal and traveling expense, bullion tax, depreciation and rescue, was 71.9c., which made the total direct and indirect costs of mining $5.439 per ton of dry, sorted ore produced.

Unit Production at Tennessee Copper Co.

A six-year record at the Tennessee Copper Co., shows that 882 tons per year are mined for each man employed at the mines.

The material treated in the smeltery and converting operations was 687,412 tons during 1910, made up as follows: Company's sulphide ore, 61.8%; custom ore, 4.6; converter slag, 1.3; blast-furnace slag, 3.9; sintered flue dust, 1.3; quartz flux, 8.6; limestone flux, 3.9; first matte, 14.6; total, 100%. One ton of coke was used for every 15 tons of material treated. One man was employed in the smelting department for every 1735 tons of material handled annually, including coke.

Sixty-three men were employed in the railroad department, handling 919,188 tons of material. This is equal to one man for every 15,000 tons handled annually.

Electric Power Costs

Some interesting figures on the cost of steam-power generation are given by the Pacific Gas & Electric Co. (*Electrical World*, Apr. 13, 1912). This corporation

P. G. & E. CO. POWER COSTS, 1911

	Cents per kilowatt-hour	
Generation:		
Labor	0.225	
Materials	0.731	
Repairs	0.104	
		1.060
Distribution:		
Labor	0.216	
Materials	0.098	
Repairs	0.191	
		0.505
Administration:		
Labor	0.271	
Materials	0.082	
Legal expenses	0.021	
Fire insurance	0.005	
Bad debts	0.026	
Advertising	0.008	
Damages to persons	0.005	
Rents	0.005	
Taxes	0.153	
		0.576
Interest on floating debt.		0.006
Depreciation		0.789
Total		2.936

generates about 86,000,000 kilowatt-hours per annum, or a load of about 9700 kilowatts.

Balaklala Smelting Operations

The record of smeltery operations at the Balaklala Consolidated Copper Co., Coram, Shasta County, Calif., as shown by the annual reports, gives the ratio of ores smelted as one ton of silicious ore to 14.1 tons of sulphide ore. The total burden to blast furnaces was composed of 77.6% sulphide ores; 5.6% silicious ores; 4.15% matte; 2.75% slag; and 9.9% limerock. The percentage of ore treated by blast furnace was 99.38%, 0.62% of silicious ores being used as converter lining.

Coke consumed equaled one ton for every 17.1 tons handled, or one ton for every 14.9 tons of copper-bearing material treated. The percentage of coke to total burden was 5.90%, and of coke to sulphides, 7.58 per cent.

Flue dust produced equaled one ton for every 49 tons of copper-bearing material treated, or 56 tons of burden. Of the total metal contents of the material treated, the flue dust contained; 1.49% of the gold; 1.21% of the silver; and 2.24% of the copper, or approximately 2.12% of the total value in dollars.

The average furnace burden per day was 453 tons, and of sulphides 352 tons. Two 52x240-in. water-jacketed blast furnaces were operated during the time this record was made. Later reports show ratio of tons smelted as follows; sulphide ores, 70.6%; silicious ores, 11.3%; flue dust, 2.6%; and limestone, 17.2 per cent. The cost of smelting was about $3 per ton treated.

Unit Costs in a Small Cyanide Mill

In a 20-stamp mill, crushing an average of 80 tons per day of oxidized ore (quartz), containing 1.93 oz. of gold per ton, 42.46% of the gold was recovered by amalgamation; 21.97% by concentration, and 29.57% by cyanide, of which 14.06% was by leaching and 15.51% by slime agitation. The unit cost of chemicals was as follows:

Cyanide: The average consumption per ton of ore milled was 2.241 pounds.

Lead Acetate: About 0.419 lb. were used per ton of ore milled.

Lime: Consumption was at the rate of 7.73 lb. per ton of ore.

Zinc Shavings: Precipitation by zinc boxes consumed 0.978 lb. of zinc shavings per ton of ore milled, or 5.751 lb. of zinc per pound of dry refined precipitates produced, and 1.69 lb. per ounce of gold recovered by cyanide. Wet, refined precipitate (vacuum dried) averaged 1.16 lb. per ton of ore milled, and after fire drying, 0.165 lb. per ton of ore, or 0.286 lb. per oz. of gold recovered by cyanide.

Quicksilver—The loss per ton of ore milled was 0.411 oz. A portion of this, however, was lodged in launders and other places where it could be eventually recovered by a thorough cleanup.

Tube Milling: The tube mills received a feed, 55.31% of which was above 40 mesh and 32.55% below 40 and above 60 mesh; 42% of the discharge was about 80 mesh, and 58% fine slimes, of which 57.31% was below 200 mesh. The consumption of pebbles, as shown by one year's record, averaged 1.5281 lb. per ton of ore milled. The tube-mill discharge contained 49% water, while the overflow (slimes) from the classifiers handling the discharge was 80.55% water. Two

trunnion-type mills were used: One 4x16 ft., and the other 4x12 ft. They were set parallel and connected to one motor by belt drive. Running at 30 r.p.m., it required 38.6 hp. for the two mills running together, while with the 12-ft. mill running alone it required 22.6 horsepower.

Shaft Sinking Costs in Wisconsin

By W. F. Boericke*

The following figures on the cost of sinking a small shaft in the Wisconsin zinc fields are in no way remarkable, but may be useful to engineers who are working under somewhat similar conditions. The shaft in question was to serve as a means of ventilation and as an escapeway for the men, and speed in sinking was deemed more important than great economy. The time was most unfavorable for outside work, the work being done in the dead of winter, at a temperature most of the time much below zero.

The shaft was made 5x7 ft. in the clear, and, except for a little top cribbing, was untimbered. It was sunk through the Galena limestone for nearly the full distance—81 ft., at which point connection was made with a raise from below. This Galena limestone, the principal rock formation of the Wisconsin zinc field, is a coarse, crystalline dolomite of great strength and firmness, and stands especially well, hence, except where a shaft is to be equipped with a cage or skip, timbering costs are almost negligible. The rock is not particularly hard for drilling, and breaks well, but the holes have a tendency to pack and do not clean well; hence drilling speed is not great.

COST OF SINKING 81 FT. IN GALENA LIMESTONE

	Total	Cost per Foot
Total labor	$553.00	$6.827
Powder, 638 lb.	70.18	0.865
Power, 81 shifts at 45c.	36.45	0.450
Total	$659.63	$8.142

Total time to sink 81 ft., 45 days of 81 shifts.
Progress per shift, 1 ft.

The shaft was sunk on a crevice and drillhole, the former running diagonally across the shaft. By pointing the holes so as to break to the crevice, better progress was made than was otherwise possible. No more water was encountered than was needed for drilling. Two shifts of three men each were employed. Wages in shaft work were $2.50 and $2.25 per shift of eight hours. The drill used was the regular first-size post Wonder, using a 3½-ft. steel. About one-third of the time was used in drilling, and the balance in cleaning out and hoisting, which was done with a hand windlass. Six to eight holes would be drilled before shooting; about 14 holes made a round. All shooting was done by electricity. About four sticks of 40% dynamite were used to the hole. The steel used was the customary eight-point bit used with Wonder machine.

In calculating the costs, powder is taken at 11c. per lb., and power assumed to amount to 15 kilowatt-hours per shift, and to cost 3c. per kilowatt-hour. Nothing was allowed for superintendence or repairs, nor for a proportion of blacksmith or enginemen's wages. These would not add materially to the cost, however.

*Mining engineer, Mineral Point, Wis.

Supplies for Locomotives

The consumption of fuel for locomotives varies greatly with circumstances, such as grades, curvature, number of cars in train, skill of engineer and fireman, etc. A record covering eight years' operations of one of the Eastern railroads shows that the consumption of coal has averaged about 182 lb. per mile, and ranged from 152 lb. to 219 lb. for freight service. In the passenger service the consumption averaged 106 lb. per mile and ranged from 98 to 116 lb. The consumption of coal for locomotives switching averaged approximately 80 lb. per mile and ranged from 64 to 105 lb.

The consumption of cylinder oil was approximately one quart for every 123 miles and varied from 99 to 147 miles per quart consumed. Approximately one quart of lubricating oil was used for every 43 miles covered by the locomotive and ranged from 38 to 48 miles per quart. Waste consumption averages 1.86 lb. per 100 miles traveled and varies slightly. Only once during the period did it average 2 lb. per 100 miles.

Openpit Mining of Mesabi Iron Ore

The report of the Minnesota Tax Commission in 1910, giving a description of the mining methods on the Mesabi iron range states that one steam-shovel crew can load up to 8000 tons of ore per 10 hr. with 4000 to 5000 tons as an average day's work. The ore is generally carried in steel cars from the pits, these cars have a nominal capacity of 50 tons each but their actual capacity is about 46 tons each.

The Mesabi ore is soft and lies near the surface in an almost horizontal plane, with a covering of 20 ft. or more of glacial drift. The orebodies vary in size, their length may be a mile or more, though this is unusual, the maximum width is approximately one-half mile, and their thickness varies from 50 to 300 feet.

The openpit system is used in nearly every case where the overburden is not too heavy. It is claimed that more material has been moved by the steam shovel on the Mesabi than the total excavation required for the Panama canal. A shovel crew consists of an engineer, crane man, and four pit men to prepare the road bed and lay track upon which the shovel stands. A spotter is employed to keep the stripping train moving as the cars are filled. A standard steam shovel weighs 90 tons and lifts from four to five tons at a time from the bank and dumps its load into the cars. The weight of the ore varies from 13 cu.ft. for 62% on to 17 cu.ft. for 49% iron ore. Including the cost of necessary stripping it is estimated that the average cost of mining the Mesabi ore by steam shovel is about 70c. per ton.

Development Work at Alaska-Treadwell Mines

Figures compiled from the annual reports, 1906 to 1910 inclusive, of the Alaska United Gold Mining Co., Douglas, Alaska, show that at the end of 1905 the total ore reserve on the 700-ft. claim was 156,236 tons, including all ore broken in stopes. At the end of 1910 the reserve had been increased to 865,223 tons, making a gain of 708,987 tons during the period. The total tons milled amounted to 1,141,670; adding this to the increase shown for the ore reserve gives a total of 1,850,657 tons of ore produced and developed on the 700-ft. claim. During the same period, 16,687 ft. of development was performed; this indicates an average of about 111 tons of ore per foot of development. On the Ready Bullion claim, located on the same vein, the reserve amounted to 1,754,350 tons at the end of 1910; this is a gain of 845,415 tons since 1905. During the same period 1,141,670 tons were milled, and 16,308 ft. of development performed, indicating an average of 121 tons of ore for every foot of development.

The annual reports of the Alaska-Treadwell show that at the end of 1906 the ore reserve was estimated at 5,049,792 tons, and at the end of 1911, 6,637,370 tons, an increase of 1,587,578 tons during the five years. The ore sent to the mill amounted to 3,728,988 tons, and 50,860 ft. of development work was performed; this gave about 105 tons of ore per foot of development.

At the Alaska-Mexican Gold Mining Co. 22,693 ft. of development was performed during 1906-1910 inclusive, according to the annual reports. At the end of 1905 the total ore reserve was estimated at 841,876 tons and for 1910, 1,093,029 tons, a gain of 251,153 tons for the five years. During the same period 1,010,737 tons were milled, based upon the total tons milled and the gain in the ore reserve, 55.6 tons of ore were secured per foot of development. The total average for the three companies is approximately 98 tons of ore per foot of development work.

How the Metals Are Sold—Copper—II

By W. R. Ingalls

An account of the customs and practices obtaining in the marketing of an important metal and the conditions that determine them.

For the most part, Lake copper is sold directly by producer to manufacturer; however, some of it is distributed through the selling agencies and some through metal brokers. The several sellers of Lake copper do not adopt the same plan in making their quotations. Some sell on the basis of New York, net cash, adding or deducting difference in freight between shipping point and New York. Thus, in selling copper for delivery at Buffalo, some producers name their New York price and deduct the difference in freight between Michigan-New York and Michigan-Buffalo. Other producers sell at a price including delivery to the manufacturer's yard, allowing 30 days' time for payment, or not, as the case may be. Some producers selling to brokers allow them a commission of 0.5% and in selling directly to manufacturers give them (the manufacturers) the same allowance, which of course is simply a trimming from the nominal price. When the bill is discounted for cash the total discount comes to 1%. This allowance is not made by all of the Lake producers.

The agencies which sell the bulk of electrolytic copper differ slightly in their methods, but in the main they are obliged to accomodate themselves to each other in order to remain competitive. The transactions in electrolytic copper come under three heads, as follows: (*A*) Sales to manufacturers situated in the West. (*B*) Sales to manufacturers situated in eastern districts. (*C*) Sales for export.

Western Sales

The manufacturers situated in the West are, as a rule, supplied by the western refiners, who have a double advantage, saving a part of the freight to the Atlantic Coast and obtaining a higher price for their product, eastern refiners being obliged to pay freight backward in order to compete. The western refiners in selling at interior points, are, however, limited by the competition of Lake copper. This will be made clear by the following example:

Assuming the price for electrolytic copper to be 12½c., net cash, New York, and the price of Lake copper to be 12¾c., same basis, if a western refiner sells at 12½c., Chicago, he saves about ⅛c. freight from Chicago to New York. In order to realize the equivalent of 12½c., cash, New York, the eastern refiners would have to quote 12.70c. at Chicago. The Lake producers can afford to sell at 12⅝c., Chicago, netting the equivalent of 12.75c., New York. Consequently, in times when there is a fair market for copper, the price in Chicago is likely to be just enough lower than the price for Lake copper to induce the buyer to take electrolytic instead of Lake and still sufficiently high to make it more profitable to the western electrolytic refiner to sell there than in New York. The result of this condition is that in ordinary times the eastern refiner does not compete in the western market. If business, however, is slack and it is difficult to sell copper, the eastern product will be offered competitively in the West, because then it is chiefly a question of finding a market and the equalization of freight becomes a secondary consideration.

Deliveries to Eastern Points

Similarly copper may be delivered to some interior points more advantageously from Baltimore than from Perth Amboy. These conditions produce complications in the competitive selling of copper at points west of the Atlantic Coast and in connection with the prevailing custom of the trade affect materially the price quoted for any particular point and the amount that the seller will net. The producer of Lake copper often finds himself embarrassed by widely different freight rates, the rate from Michigan to Connecticut by rail being about 34c. and by water and rail only about 18c. This materially influences his attitude toward the market at the opening and closing of navigation and gives play to the operations of shrewd outside speculators at about those times.

In selling upon the basis of price delivered to domestic manufacturers, with time allowance, or discount for cash, the freight that is paid by the sellers differs naturally according to the respective situation of the refinery and the manufacturers' works. Thus, while the refiners at Perth Amboy have merely to pay a switching charge for delivery of copper to a Perth Amboy wire mill, a refinery situated on Long Island has to pay a lighterage charge or a freight charge. The freight from the principal refineries around New York to the principal mills varies from a switching charge of 1c. per 100 lb. to a rate of 18c. per 100 lb. It has become the custom among the principal selling agencies to quote a uniform rate, disregarding differences in freight, the idea being to treat all consumers alike and the assumption being that in the long run the freight will equalize itself. A very large part of the shipment of copper goes to the Naugatuck valley in Connecticut, the freight rate to there being about 10c. per 100 lb., which expense is generally assumed to be about the average. This rate, however, applies to only part of the shipments, a large part of the Western copper going through on milling in transit rates, which reduce the cost of delivery from New York to 4½@7½c. per lb. The producers who sell copper to domestic manufacturers in the East, are consequently subject to freight charges of from 4½ to 12½c. per 100 lb., or even a little more to some out-of-the-way places.

The terms, cash 30 days after arrival, are generally reckoned as corresponding to an average interest loss of 45 days, which amounts to a little more than 10¼c. when figured on a price of 14c. per lb. and at 6 per cent. interest. Several of the large agencies sell at the flat discount of 0.5% for cash upon delivery, which is 7c. per 100 lb. when the price of copper is 14c. The net cash equivalent, New York, of a sale "delivered, 30 days," is consequently from 12½ to 20c. per 100 lb. less than the commonly quoted price. What the producer realizes comes back, of course, to the basis of New York, cash. The variation in terms is frequently a method of shading prices without jolting the nominal position of the market.

Sales to Europe

Sales to Europe are made by the several agencies through their European connections or agents. None of the American agencies or producers sells directly its copper to European manufacturers. A custom similar to that in the domestic trade exists with respect to quoting a uniform price for delivery at various ports regardless of difference in freight. In times when business is brisk an exception is likely to be made in quoting for delivery to the so-called "outports," to which the freight rate is materially higher than to Liverpool, London, Rotterdam and Hamburg. However, in times of keen competition some of the sellers prefer to waive the differential for the so-called "outports" rather than to reduce their price.

The average freight rate to regular ports in Europe is about 11c. per 100 lb.[1]; the insurance amounts to about 1.3c., interest and banking expense 3c., and

[1]This refers, of course, to what may be considered normal conditions. Lately there has been a sharp rise in ocean freights, which has affected copper shipments as well as other commodities. Thus, the rate on copper from New York to Liverpool has gone from 7s. 6d. to 15s. (from 8.1 to 16.2c. per 100 lb.); the rate from New York to Hamburg has gone from 10c. to 16c. per 100 lb.; and the rates to other ports about the same way.

brokerage (at 0.25%) 3c., making the total of charges about 18.3.[2] The terms of payment for European sales vary; common conditions are three days' sight draft, or sight draft on consumers, or cash on arrival of steamer. In either case the seller suffers a certain loss of interest or a loss in the rate of exchange. Some sellers extend credits to European buyers and in consideration thereof sometimes receive higher prices, the credits ranging from two weeks to three months. It is a common custom when making sales to Europe on credit to sell the risk to a bank at an expense of ¼ to ½%. The average cost to the seller of delivering copper to regular ports in Europe is about 17½c. on the average, some figuring it a little higher (20c.), some a little lower (15c.)

With respect to what is actually netted by the seller it appears, therefore, that there is no material difference between the selling for delivery in America and in Europe upon the usual terms in each case, i.e., when ocean freights are normal.

Casting Copper

The market for casting copper is relatively narrow and erratic. In the market for this sort the smelters of scrap and junk figure prominently, their product being casting copper and trade customs are not so firmly established as they are in the market for other kinds of copper. This is to say, casting copper may be sold in almost any way that occurs to the imagination and may be agreed upon by the parties concerned. It is sold upon the basis of cash, New York, and upon the basis of delivery, with or without time allowance. Time allowance may run to considerably more than the 30 days commonly allowed on electrolytic bills. The credit of buyers and sellers is also a more important consideration in this market than in the others.

In general casting copper is worth from 12½ to 20 points less than electrolytic, but the ordinary disparity may not always appear in the records of actual transactions. Electrolytic copper is quoted upon the basis of a wholesale market in the broadest sense, while the business in casting copper is always relatively of a more or less retail character. Thus it may actually happen that transactions in casting copper may be made at a higher price than for electrolytic, which, of course, is in no way a true index of actual market conditions, but merely the difference between a retail and a wholesale market.

Neither casting copper nor cathode copper is a reliable basis for commercial calculations, except in so far as concerns transactions in those particular forms, which in fact are of minor importance. Lake copper is a more valuable index inasmuch as its sales represent upward of 200,000,000 lb. per annum, and the record of Lake prices is important because it goes back to the early years of copper production, while the record of electrolytic is still comparatively brief. The real index of the copper market is the price for electrolytic copper and that ought always to be the basis, both casting and cathode copper being subject to erratic and non-indicative variations.

Contracts

The expression of "the spot price for copper" is sometimes used, but it is substantially meaningless. There is no stock of copper in warehouse at New York that is capable of delivery on demand. There may be such a stock at the refineries, but even when the refiners have an ample supply of refined copper on hand, about 10 days after receipt of order is usually expected as an allowance of time in which to conform to specifications as to shape of bars, etc. Such a filling of an order would be called "prompt delivery." The bulk of the copper is not sold in that way but rather is sold on contracts for forward delivery. Few manufacturers conduct their business upon the basis of hand-to-mouth buying, although they may approach that condition in periods of great plethora of supply, such as existed in 1910 and 1911. A manufacturer receives orders for wire, brass and other goods to be delivered at a subsequent date or during a period beginning with some date. Knowing pretty nearly what his requirement for copper is going to be, he places contracts with the agencies for delivery on their part at corresponding periods. The agencies are generally desirous of providing for the disposal of their product as far ahead as possible, but neither buyer nor seller is commonly disposed to take chances on the market for more than two or three months ahead. This practice of contracting explains the alternating periods of dullness and activity in the copper market. Having during January, let us say, arranged for their February and March copper, buyers may keep out of the market for a month or more before opening negotiations for their April requirements, especially if recession in the market is anticipated. On the other hand, if an advance is expected, they are likely to keep right on in their buying, keeping steadily booked up for two or three months ahead. Some manufacturers contract for their supplies upon the quotational basis, ordering their requirements from day to day, or from week to week, as wanted, and settling upon the basis of the monthly average. The manufacturers who do this escape the risk of speculative pinches (losing also, of course, the chances of speculative profit) but in the long run undoubtedly come out as well as the manufacturers who rely wholly upon their trading ability.

European manufacturers as a rule are compelled to cover their wants further ahead than the American because by far the larger portion of their supply must be brought over sea. A manufacturer who needs a certain shape of wire bars at his mill in Germany in March, for example, will have to buy it ordinarily in January for February shipment from the United States. The London standard market creates a complication for the selling agencies and no matter whether they like it or not, they have to graduate their quotations for forward delivery somewhat according to the premium that may be being paid for standard for forward delivery. If they should not do that their copper would ultimately find a market in London anyhow.

The custom of contracting for future requirements that prevails in the industry not infrequently leads to irregular conditions. Thus in periods of extraordinary demand, as in 1906, when stocks on hand had been substantially exhausted and refiners had become substantially sold out for one or two months ahead, a belated manufacturer requiring immediate delivery may be obliged to offer such a premium as will induce some holder to resell or to uncover some reserve supply. On the other hand, in periods when the condition of the market is the opposite a producer needing immediate cash may be unable to sell in such a way as to produce it except at a sacrifice, but may be able to sell for forward delivery and instead of waiting for his money may discount his contract. Transactions of either kind are small in relation to the great volume of business.

Speculation

Speculation in the copper business in this country is severely discouraged, for the simple reason that the producers and agencies are primarily concerned with the merchandising of copper. They cannot regulate the European market in this way and are obliged to meet conditions over there as they find them, but in this country they can and do refuse to sell to any but manufacturing interests. The refusal does not necessarily take the

[2]The bank commission (1.5c.) may be saved by drawing directly on customers, but such drafts are frequently subject to foreign stamp taxes, and moreover a draft on a commercial or industrial concern cannot be sold so well as a draft on a bank, wherefore the net result is likely to be about the same as if the drafts be sent to a bank for collection, with a commission to the bank, which is the practice of some of the selling agencies. The interest (1.5c.) is always a disputed item in these calculations. Some of the agencies figure it, some do not. Some concerns reckon the brokerage at upward of 0.25%, there being few, if any, of the sellers who are not subject to higher charges than that nominal rate. Some figure 5c. per 100 lb. with copper at about 14c. These points explain the differences of opinion respecting the charges upon European shipments that exist among the selling agencies.

form of an absolute declination, but may be conveyed by the quotation of a prohibitive price. All of the agencies do not, however, consistently follow this policy. Some of them at certain times have distinctly encouraged speculative participation even on the part of persons who are no more concerned in the copper industry than they are in cotton or coffee, undertaking to carry copper on margin in the refinery yards. The seller may later on be plagued by the competition of copper in his own yard. This kind of speculative business is by no means general.

It is possible, of course, for speculation to be carried on in other ways, either regularly or only occasionally. Thus the representative of an European buyer who has purchased for export may turn around and resell in this country. Similarly a manufacturer who has contracted for copper not yet shipped from the refinery may offer it for sale on his own account.

In spite of the discouragement of speculators pure and simple and also of brokers, a few manage to do business under handicaps. Some of the Lake producers do not hesitate to sell to brokers and at certain times it is fancied that electrolytic copper may be put in their hands by some of the great agencies, which, while ostensibly out of the market, asking a price that they are unable to get, are not averse to cutting prices vicariously.

A consideration of all of the conditions that have been discussed in the foregoing sections of this article will explain why business in copper on the metal exchange of New York practically disappeared and why it has been impossible to revive it. The producers and agencies, now few in number, are able to merchandise their copper without the intermediary assistance of brokers and middlemen. The customs that have developed in the trade, moreover, do not conform to the customs of trading on an exchange. The American market for copper is in the offices of the agencies and not "on 'change." The few transactions that take place on the latter are insignificant and command no general attention.

Market Information

The question may be asked, how do dealers in an unorganized market, a market in which there is no public exchange, truly speaking, obtain the information that is necessary for the conduct of sharp competition. In fact this is done in the same way as in the market for pig iron and many other substances. In this present era of the telephone, physical meeting between buyers and sellers is unnecessary. Inquiries are made and transactions involving large sums of money are consummated over the telephone.

The agencies manage to keep well posted through their elaborate organizations and continual intercourse with buyers. Offerings in Europe are promptly cabled back to New York. Domestic buyers generally do some "shopping," and frequently communicate information about what is offered to them. The would-be seller whose offer is rejected knows of course that his price has been cut by some one else. The invitation to manufactures to make bids throws light upon the situation in a dull market. These and similarly ordinary exchanges of bids and offers exhibit the nervous system of the copper market. Of course the London market is always a factor.

It happens occasionally in certain periods of excitement that an agency may buy copper at a certain price and immediately resell it at difference of 10 points, or vice-versa, just as on the stock exchange transactions sometimes occur contemporaneously in the same crowd at a material difference in price. However, such inequalities are soon smoothed out as conditions become calmer.

Absolute Price

There is no way of determining the absolute price for copper from day to day or even from year to year, as must be evident from a consideration of the market conditions that have been outlined and discussed in this article. By "absolute price" I mean the average that might hypothetically be obtained by dividing the proceeds of all of the copper sold by the number of pounds sold. An approximation is all that can be expected.

In the record of the JOURNAL the daily quotation is essentially quantitative. i.e., it is aimed to represent the bulk of the transactions, basis New York, cash. The small lots occasionally sold at premiums figure almost disappearingly small when averaged in the great volume of transactions. The monthly and annual averages are simple arithmetical means.

Many of the producers state in their official reports the amount actually received for their output; their averages are of course quantitative individually. It is impossible to arrive at a general quantitative average because many producers fail to report their figures and also because those that do report employ different methods of bookkeeping. Some report the net receipts on the basis of New York, but many state the gross receipts upon delivery and debit freight and other charges in another account. The matter of interest is generally disregarded.

In any given year there is a moderately wide difference among the averages reported by individual companies. This is explainable partly by the variation in methods of accounting referred to in the previous paragraph, and partly by differences in selling. All producers are no more likely to realize the same price for their copper than are all farmers for their wheat; some sell more judiciously and alertly than others. Some may sell but sparingly on a declining market and find themselves ultimately compelled to dispose of large blocks at the lowest price, while others may be successful in the policy of reserve in the opposite way.

Two Distinct Selling Policies

There have been during recent years two distinct policies in selling on the part of agencies. Some have distinctly conformed to the system of reserved selling above indicated, remaining to a large extent out of the market for long periods, unable to realize the price asked by them. Other agencies have followed the policy of selling all the time, taking the price that could best be obtained. In periods of dull and declining markets this policy of constantly pressing sales has been quite irritating to other agencies desirous of starving manufacturers into paying their price asked. The copper market has, however, been always an open one, save for the brief attempts of the Secretan Syndicate and Amalgamated Copper Co. to corner it (both of which were colossal failures) and has historically obeyed the law of supply and demand. Some of the agencies take in immense quantities of crude copper under contract and they are naturally bound ordinarily to sell it more or less in the ratio of its acquisition. On the other hand the producer who is selling through an agency on commission may be more disposed to carry his output awaiting a favorable time for its sale.

While the different policies in the market may lead to materially different averages in any single year, it seems from such evidence as is available that in the long run there is no great difference in the results. This refers to the comparative experience of individual companies. Considering the results of all companies year by year a summary of the figures of those reporting publicly affords a fair approximation to a true quantitative average. A study of these figures indicates that the producers generally fall a little short of attaining the quotational average. A consideration of the psychology of buying and selling affords an explanation of this. In a declining market, frequently started by large selling by one or two concerns more farseeing than the others, the time is soon reached when buyers themselves become frightened and but little of the commodity can be marketed until speculators become interested in taking over large quantities at or near the bottom,

which usually marks the turn of the tide. Upon an upward movement sales usually become smaller as the culminating point is approached. Thus in 1907 the quantity of copper sold at 25c. and upward was relatively small. The decline started with some heavy selling, but upon the long descent business was comparatively light and did not become large until 12c. and under was reached. The quantitative average in that year was extraordinarily lower than the quotational.

Sheet and Wire

The manufacturers of wirebars, sheet, brass, etc., purchase wirebars, cakes and ingots. The consumers obtain their copper upon the basis of those manufactures, the prices of which do not fluctuate in so mobile a manner as does that of the raw material. During the last four years, the average difference between wirebars and wire was 1.7c. per lb.; between cakes and sheets 5⅞c. per lb. The price for wire was quoted by a pooling agreement until about the beginning of 1911. Upon the disruption of the pool the wire business became strenuously competitive and prices were cut in some cases to the manufacturing margin, which is commonly reckoned at about 1c. per lb. In general the official price for wire has corresponded with the market price for wirebars, i.e. over long periods, although at many times it has been out of tune, the fluctuations in the price for the metal not always having been quickly reflected. This has given some large users of wire an opportunity to play both markets, buying either wire or wirebars to be drawn on total according to variations from the normal difference.

Government Investigation of Health of Miners

Washington Correspondence

An arrangement has been made with the Public Health and Marine Hospital Service by which one or more surgeons connected with that service will carry on jointly for that service and for the Bureau of Mines investigations looking to the improvement of mine conditions. It is important that this work be extended more rapidly, since tuberculosis and hookworm are known to be prevalent among miners in certain districts; the large and continuous influx of foreigners to the mining regions will probably bring to an increasing extent hookworm and other diseases that abound in parts of Europe.

The investigations aim to determine, among other things, the most effective sanitary precautions to be observed in and about mines and the relative healthfulness of occupations pertaining to mining and metallurgical industries.

German Steel and Iron in 1911

The production of steel in Germany in 1911, as compared with 1910, shows a considerable gain, the figures for the two years being as follows, in metric tons:

	1910 Tons	1910 Per Cent.	1911 Tons	1911 Per Cent.
Acid converter	171,108	1.3	187,359	1.3
Acid openhearth	140,189	1.0	281,877	1.9
Acid castings	111,959	0.8	102,018	0.7
Total acid	423,256	3.1	571,254	3.9
Basic converter	8,030,571	58.6	8,640,164	57.5
Basic openhearth	4,973,569	36.3	5,501,147	36.6
Basic castings	151,852	1.1	167,354	1.1
Total basic	13,155,992	96.0	14,308,665	95.2
Crucible	83,202	0.6	78,760	0.4
Electric	36,188	0.3	60,654	0.5
Total	13,698,638	100.0	15,019,333	100.0

The total increase in 1911 was 1,320,695 tons, or 9.6%. The gain in both basic converter and basic openhearth steel was large. In acid openhearth steel there was a large proportional gain, though the total quantity was small. The converter holds its superiority over the openhearth furnace, as it has in Germany for a long time. In giving the quantity of direct castings, no statement of the process used is given, but it is understood that the greater part was made in the openhearth furnace. A noteworthy feature was the large comparative increase in steel made in the electric furnace. Probably this is one cause of the decrease in crucible steel, which is the only form showing a loss in 1911, except acid castings.

Iron Consumption

Consumption of pig iron in Germany is estimated as below, imports and exports of steel and other finished products being reduced to approximate terms of pig iron:

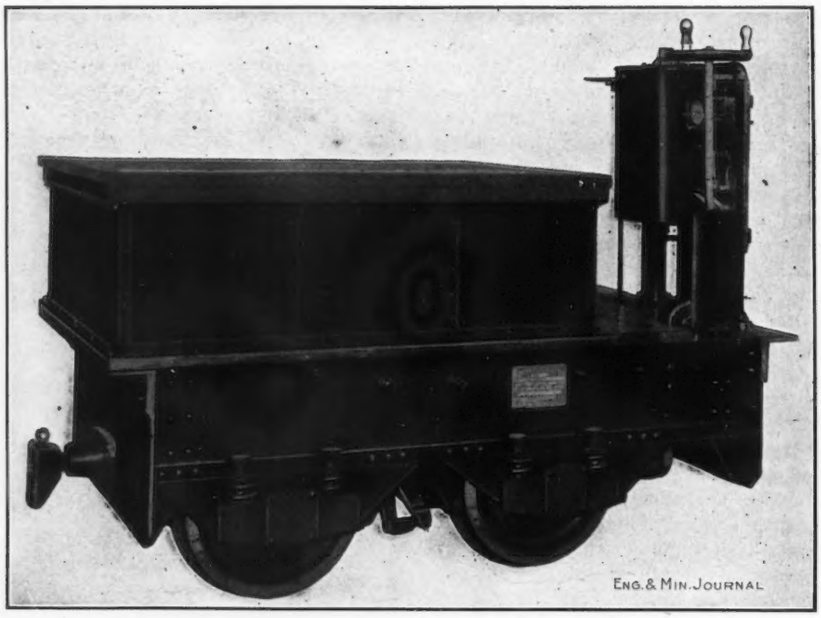
	1910	1911	Changes
Production of pig	14,793,325	15,652,004	I. 858,679
Imports of pig	383,535	412,501	I. 28,966
Imports in steel, etc.	376,200	434,672	I. 58,472
Total	15,553,060	16,499,177	I. 946,117
Exports of pig	934,061	1,003,607	I. 69,546
Exports in steel, etc.	5,825,850	6,508,440	I. 682,600
Total exports	6,759,901	7,512,047	I. 752,146
Consumption	8,793,159	8,987,130	I. 193,971

Production of pig iron in 1911 is estimated at 237.43 kg.; consumption at 136.87 kg. per head of population.

Storage Battery Locomotive in Tunnels

The storage-battery electric locomotive of the type shown in the accompanying illustration, is built for hauling loads for short distances at low speed, in places where the trolley system is not feasible.

Six of these locomotives, manufactured by the General Electric Co., are in operation in one section of the New York Aqueduct, now being constructed for conveying the Catskill water supply into the city. Each locomotive has a maximum load haul of half a mile per trip.



General Electric Storage-battery Locomotive

These locomotives have the following specifications: Diameter of wheels, 22 in.; wheel base, 36 in.; length over all, 7 ft. 10 in.; height over batteries, 4 ft.; total weight, 7500 lb. The batteries are 44-cell, 21-plate type, and have 45-amp., 6-hour discharge capacity. The cells are grouped in four or more trays and are mounted in a sheet-iron frame with wooden base and cover, on top the locomotive frame. The automobile type of motor is used, for which high efficiency, large overload capacity and practically sparkless commutation are claimed. The motor is compactly designed and is said to be dust and moisture proof.

Tests of Zinc Dust for Cyaniding

By W. J. Sharwood

Chemical and mechanical methods for examining zinc dust are given, together with results obtained and conclusions reached from the examination of different samples. The efficiency of zinc dust in cyaniding depends largely on its extreme fineness, so at least 95% should pass 200 mesh. Exposure to moist air causes rapid oxidation and consequent loss in efficiency.

The increasing interest among members of this society in zinc dust as a precipitant has suggested the publication of details of a few tests which have proved of some use in examining and comparing samples of it. Unfortunately no very definite criteria have as yet been established for valuing zinc dust for precipitating purposes, but the following will serve to give some idea as to the availability of a sample for the cyanide plant.

Specifications for Zinc Dust

It should be dry and fine; nearly all, say 95%, should pass a sieve of 200 meshes to the linear inch (aperture 0.003) while very little, say not over 1 or 2%, should remain on 100 mesh (0.006 in.), and practically none on 50 or 60 mesh. It should not show any signs of caking, or contain lumps which do not break up at once when shaken on a sieve. Generally speaking, an ash-gray color is a more favorable indication than a decidedly blue or whitish cast; but color cannot be taken as a positive criterion. The presence of a little lead, say 2 or 3%, is an advantage.

Laboratory tests made with pure zinc, and with equal weights of alloys containing up to 5% lead, in the same state of fine division (filings between 0.006 and 0.003 in.), have invariably shown more rapid and more nearly complete precipitation of gold and of silver in the case of the lead alloys, although the weight of actual zinc present was less. The presence of a little zinc oxide is apparently without detrimental effect, except as diminishing the percentage of active metal. Attempts to remove the oxide by solvents inevitably lead to the dissolving of more or less metallic zinc, and possibly to the destruction of the finest particles. No injurious effect has been traced to the small amount of cadmium usually present, and other impurities are generally negligible in amount. A number of samples which have proved satisfactory in actual use have shown from 85% to over 95% metallic zinc (i.e., zinc in the metallic state), most of them over 90 per cent.

Various published analyses have shown metallic zinc ranging from less than 30% up to 92%; zinc oxide from traces to over 50%; and cadmium from traces up to 1.3% in Belgian, and 1 to 2.5% in Silesian samples. A number of analyses from various sources are to be found in Schnabel's "Metallurgy" under Zinc, Ingalls' "Metallurgy of Zinc and Cadmium," and in "Mineral Industry," Vol. II, p. 258. Some of these show carbon up to 3 or 4%, and silica or insoluble up to 9 or 10%, but in general very little of either will be found, and only traces of iron or arsenic. A few of these analyses are summarized in the accompanying table,

Note—An article entitled "Zinc Dust Tests," published in Journ. Chem., Met. and Min. Soc. of South Africa, February, 1912.

together with partial determinations of some samples used in gold precipitation.

Various authorities state the specific gravity of zinc as from 6.85 to 7.21, of zinc oxide from 5.6 to 5.78, and zinc carbonate 4.3 to 4.5. Samples of zinc dust have shown results from 6.28 to about 7.0, while the material itself weighs from about 2 to 2.5 grams per c.c., or about

TYPICAL ANALYSES OF ZINC DUST

	Metallic Zinc	Zinc Oxide	Lead	Iron, Cadmium, Carbon, and Insoluble
(1) Belgian...	91.5	little	0.5	....
(2) Belgian...	88.74	6.60	2.5	2.1
(3) Belgian...	79.16	11.26	1.9	7.2
(4) Average (Belgian)...	84.5	9.3	1.6	4.0
(5) Silesian...	84.5	4.9	4.3	6.2
(6) Silesian...	88.5	7.4	2.0	....
(7) Silesian...	.....	88.2	4.0	3.0($SO_3$4.1)
(8) American..	29.6	57.5	trace	(Insol. 9.6)
(9) American, good quality	96.0	...	..	....
(10) European, imported into U. S., good quality.....	90.9	4.0	2.7	....
(11) European, similar, fair quality.....	85.0	...	2.0	....
(12) European, similar, fair quality.....	94.6	3.7	0.2	(Iron 0.3)
(13) Used at Deloro, Canada	.....	3 to 5	1.74	....

Note—Nos. 1-4 by Firket, 5 to 7 by Steger, 1-7 quoted by Ingalls; 7 and 8 from Schnabel, intermediate products in smelting; 10, analysis supplied by importers, quality excellent; 13, Harland, Journ. Soc. Chem. Ind., 1897, p. 968; 9, 11, 12 original; Nos. 9 to 13 used in cyanide precipitation at various plants.

120 to 155 lb. per cu.ft., depending largely upon the extent to which it has been shaken down. No connection has been proved between the apparent density and the quality, but at least one "heavy" sample was found to give unsatisfactory precipitation.

The following serves to illustrate the desirability of avoiding contact with moisture or moist air in the transportation and storage of this material. On a carload of imported zinc dust used some years ago in Montana, the railroad charges were found to be based on a considerably greater weight than was indicated by the weights of the several casks invoiced as originally shipped from Europe. The total weight found by the daily use of the material bore out the railroad figures, and confirmed the suspicion that the discrepancy was due to oxidation from contact with moist air. This was further proved by analyses for oxide and metallic zinc, a sample taken near the staves of one cask showing about 10% more oxide than another from the middle of the mass. In another case, where bad precipitation was noted, the material from the bottom of one barrel was lumpy and yielded 39% zinc oxide, while a sample from near the top of the next barrel opened contained 13.5 per cent.

Estimation of Lead in Zinc Dust

Weigh 10 grams into a large beaker (400 to 600 c.c.), moisten with water, then add 200 c.c. water and stir well, then 10 c.c.[1] strong sulphuric acid, stir well and cover. Stand beaker on a hot plate and warm to 60 or 70° C.; if action is very slow at the start, add a single drop of very dilute platinic chloride solution; stir at intervals. After action becomes slow add 10 c.c. more acid and continue warming until nearly all the zinc has dissolved. Decant the solution upon a filter, wash the residue in beaker two or three times with water, passing washings over the filter[2]. Rinse residue back from filter into beaker.

Dissolve residue with a little nitric acid[3], transfer to a casserole and rinse beaker into casserole. Add 5 or 6 c.c. strong sulphuric acid and evaporate to dense fumes. Cool, dilute with water, stir well, cool thoroughly, filter, wash well with water containing 5% sulphuric acid[1]. Dissolve the lead sulphate in hot ammonium-acetate solution, and wash filter thoroughly with the same solution. Dilute this solution with hot water (about 80° C.) and titrate the lead with standard ammonium molybdate, using 1% tannin or ferrocyanide solution as outside indicator.

The molybdate is standardized on pure lead foil, treated in the same way as the

[1]The use of 25 c.c. of strong hydrochloric acid, in place of 10 c.c. sulphuric acid, gives equally satisfactory results.

[2]The two filtrates from the lead and lead sulphate contain the iron, cadmium and zinc; they may be mixed, made up to a definite volume, and these metals determined in suitable aliquot portions.

[3]If any considerable residue (silica, carbon, etc.) remains at this stage after treatment with nitric acid, it may be filtered off, washed thoroughly and determined. If in this case a white residue remains after washing it should be treated with hot ammonium acetate solution, and this should be added to the acetate solution obtained later.

lead residue from the zinc dust. If the ferrocyanide titration is substituted for the molybdate method, the same standard solution will serve for both lead and zinc.

Estimation of Zinc Oxide

An approximate method, based on the solubility of zinc oxide in ammonium chloride and ammonia, is given herewith. The solution required consists of: 250 c.c. water; 70 grams ammonium chloride, and 150 c.c. strong ammonia water (sp.gr. 0.90). Weigh out 1 gram of the zinc dust, put into a stout test tube holding 35 to 50 c.c. Use a disk of soft-rubber packing $\frac{1}{16}$ in. thick as a cover for the tube, or use thumb as cover while shaking. Add 25 c.c. of the prepared solution, cover tube and shake well for exactly five minutes. Agitation must be violent enough to insure all lumps being broken up. Throw mixture promptly on a 9- or 11-cm. filter, rinse tube and wash filter with hot water, receiving in a 200- or 250-c.c. beaker. Dilute filtrate with hot water to about 100 c.c. Add a drop of phenolphthalein indicator, then HCl till about neutral, then 5 c.c. strong hydrochloric acid. Heat to 80° C. and titrate with standard ferrocyanide, using uranium acetate or nitrate as indicator. Zinc found in solution × 1.245 = zinc oxide in 1 gram.

This method is rapid and gives fairly approximate results, which are closely comparable if constant conditions are maintained in all tests. The results are slightly high, for the reason that metallic zinc is itself slightly soluble in the solvent employed, but there is no known solvent for the oxide which will not also attack the metal. Tests with freshly prepared zinc filings, passed through a 200-mesh sieve, show that the error from this source is negligible if only five minutes' contact is allowed with the above solution. Carbonate of zinc dissolves in the same way as the oxide.

Dissolve 1 gram of dust in dilute hydrochloric acid, heating moderately. Make up to 200 or 250 c.c. in an accurate flask, remove 50 c.c. with an accurate pipette. Add 5 c.c. strong hydrochloric acid, and about 2 grams ammonium chloride, dilute to about 200 c.c. with hot water, heat to 80° C. and titrate with ferrocyanide. The ferrocyanide solution is standardized on pure metallic zinc, dissolved in hydrochloric acid and treated as above.

Determination of Metallic Zinc in Zinc Dust

Many methods have been worked out, most of which are not altogether satisfacotory. Those which depend on measuring the volume of hydrogen evolved by the action of acid are hampered by the slow rate at which zinc dust dissolves in dilute acid, and by the readiness with which hydrogen diffuses through rubber tubing and leaky connections. A number of the methods proposed are given in Sutton's Volumetric Analysis. (10th ed., p. 382-383.)

I. Very good results are obtained by determining (1) total zinc, and (2) zinc in the form of oxide, by the methods above given. The difference is assumed to be metallic zinc. This has the advantage of requiring only one standard solution, potassium ferrocyanide, for both titrations.

II. Reduction of chromic acid, by subjecting the zinc dust to the action of potassium bichromate acidified with sulphuric acid. The bichromate should be present in considerable excess of the calculated amount necessary for the zinc used. The residual chromic acid is determined by titrating an amount equal to that originally taken, and the solution after the zinc has acted, or aliquot parts of each, either:

(1) by means of KI, titrating the liberated iodine with thiosulphate (Sutton, p. 383), or
(2) by means of a standardized solution of ferrous sulphate.
(3) by adding an excess of a standardized solution of ferrous sulphate and completing titration with standard bichromate.

III. Reduction of ferric chloride or sulphate and titration of the ferrous salt obtained by standard permanganate or bichromate. Sutton (p. 383) recommends using 0.5 gram zinc dust with 7 grams of ferric sulphate and titrating one-fifth of the solution with permanganate. Presumably 14 or 15 grams of ferric alum would answer equally well.

IV. The reduction by the zinc dust of a solution of iodine in potassium iodide has given fair results, but it is only safe to use rather small quantities, say 0.1 or 0.2 gram, titrating the residual iodine with thiosulphate.

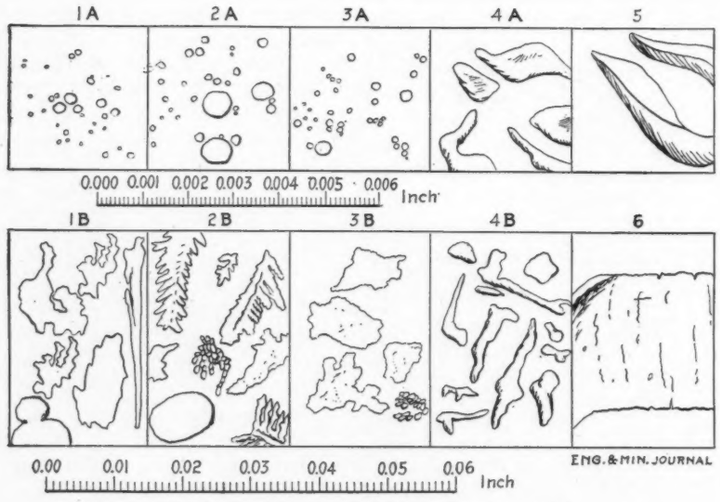
The following are results obtained with a sample of zinc dust: Method I. Total zinc, 91.6%; zinc as oxide (and carbonate), 12.9%; metallic zinc by difference, 78.7%. Method II. Metallic zinc by reduction of bichromate (3), 79.6%. Method III. Metallic zinc by reduction of ferric alum, 77.1%.

Whatever reduction method is employed for direct determination of the metal, the metallic zinc can be calculated thus: 1 c.c. $N/10$ standard solution = 0.00327 gram zinc.

Determination of Precipitating Efficiency

A solution of potassum silver cyanide is prepared by dissolving 10 grams silver cyanide (AgCN) and 5 grams of "99%" potassium cyanide in a little water and diluting up to 1000 c.c. It is then adjusted by addition of a little more KCN or AgCN until the solution indicates from 0.12% to 0.15% free KCN by titration with standard silver nitrate. The titration is best made by using a 10-cc. or 20-cc. sample, adding 1 cc. of 2% potassium iodide, and a slight excess of ammonia, the end-point is then sharper. Or 15 grams of pure crystallized $KAg(CN)_2$ may be dissolved in a liter of water and 1.5 grams KCN added.

Weigh out 0.5 gram zinc dust into a 300-c.c. beaker. Add a few cubic centimeters of water and stir until zinc is well mixed, then pour in 250 c.c. of the prepared solution, stirring vigorously. See that all lumps are broken up, and continue stirring for fully five minutes. Stir occasionally (at least every 10 minutes) until the end of two hours from the addition of the solution. Then filter upon an 11-cm. filter, wash precipitate thoroughly, sprinkle with test lead, wrap it carefully in the paper, place in a scorifier with about 20 grams test lead, burn paper cautiously in muffle, scorify five minutes,



Zinc Dust and Shavings Under the Microscope
(1), (2), (3) Zinc dust. (4) Granular zinc. (5) Zinc filings. (6) Zinc shaving.

cupel at low temperature and weigh silver. Milligrams silver obtained from 0.5 gram zinc × 0.0606 = percentage precipitating efficiency.

By taking 0.303 gram zinc dust instead of 0.5, each milligram of silver is equivalent to 0.1% efficiency. Instead of cupelling, the silver may be dissolved in dilute nitric acid and titrated with standard thiocyanate with ferric indicator, using the whole or one-half of the solution for titration. Each c.c. of *N*/10 KCNS used for 0.5 gram × 0.654 = percentage efficiency.

This test was devised by A. J. Clark, in 1904, with the idea of utilizing a reaction similar, and taking place under similar conditions, to those actually prevailing in the every-day use of the zinc dust in the cyanide plant. While the results obtained by this method are not entirely satisfactory, they have afforded, during seven years' experience, a better indication of the results to be expected in practical work on the large scale, than those obtained by any other system of examination so far tried. Satisfactory samples of dust usually show efficiencies between 40 and 60%, and sometimes as low as 35%, 100% being the standard calculated for the complete replacement of pure zinc by silver. A better method, one which completely eliminates the personal factor in manipulation, is desirable, but a simple determination of the metallic zinc is not sufficient; the test must automatically take into account the physical condition as well. Attempts to carry out the test in a mechanical shaker, and determining the silver left in solution after filtering after a special time of contact, have always given much lower results than are obtained as above.

Mechanical Tests of Zinc Dust

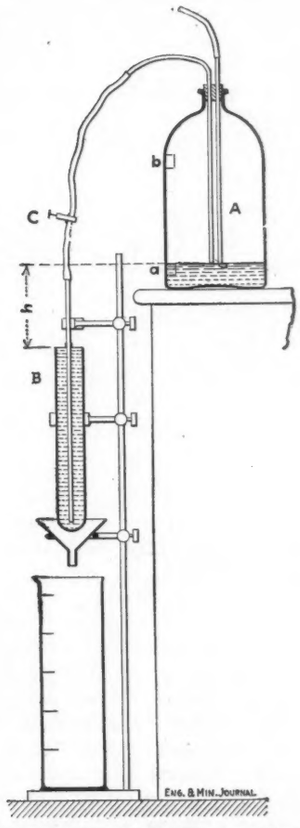
In sizing tests, with sieves of 100 and 200 meshes to the linear inch, using a sample of 20 to 50 grams, good samples of zinc dust usually show at least 95 and often 98 or more per cent. passing the 200 mesh, and not more than 1% remaining on the 100 mesh. This sizing is irrespective of caked lumps, which should never be found in freshly opened barrels.

The elutriation test is based on the separation of the finest particles by a rising stream of water in a vertical tube, the velocity being about 1 cm. per second. It promises to throw some light on the fineness of division of the portion passing 200 mesh, which, as above indicated, ought to include nearly all the material.

Apparatus for Elutriation Test

A convenient arrangement is that shown in the accompanying illustration. A 2500-c.c. acid bottle *A* is fitted with a 2-hole rubber cork, with a Mariotte tube reaching nearly to the bottom and turned at a right angle at the lower end, and a siphon outlet tube reaching to about the same level, thus giving a constant-level water supply. A mark is placed at *a*, the level to which the siphon empties the bottle, and another at *b*, to indicate the surface when 2000 c.c. additional water have been put in. The working cylinder *B* may be a tall 250-c.c. measuring-glass, but it is better to use a large tube with rounded end, say 1.25 in. diameter by 12 or 15 in. long, with a ¼-in. glass tube placed centrally in it and connected with the siphon by a rubber tube with a spring clip *c*, both being fastened to a stand by clamps. A large graduated cylinder and funnel are placed below.

The net area of the cross-section of the working cylinder is best obtained by sticking two labels or making two marks on it 20 cm. apart, then filling with water



Apparatus for Elutriation Test of Zinc Dust

to the lower mark and measuring the number of cubic centimeters required to fill it to the upper, the central tube being clamped in place. Then the area of cross-section (= volume in c.c. ÷ height in cm.) is obtained once for all.

To adjust the velocity fill the bottle to the upper mark, fill working cylinder, open spring clip and take time with a stop watch while 1000 c.c. flow out.

$$\frac{1000\ c.c.}{Area \times No.\ sec.} = velocity\ in\ cm.\ per.\ sec.$$

By raising or lowering the working cylinder, the velocity can be adjusted, the effective head *h* being the vertical distance of the top of the cylinder below the level of the Mariotte-tube inlet, the velocity varying approximately as the square root of *h*. The clip on the siphon should be removed or kept wide open during the test, and care should be taken that the rubber connections are not sharply bent or allowed to obstruct the flow. When the point is found at which an upward velocity of exactly 1 cm. is obtained, or some point sufficiently near, it is well to mark the position of the cylinder and clamp or measure the height *h*, so that this position can be reproduced, all the other adjustments remaining the same.

Method for Making Test

Put 20 grams of zinc dust in the cylinder, moisten with a little water, then add 50 or 100 c.c. and stir until all air bubbles are removed, then fill cylinder with water. A wire stirrer is used, reaching to the bottom. The bottle being filled to *b*, open clip and start the flow. Use the stop-watch as a check on the velocity, timing the first 1000 c.c. The wire stirrer must be used at first to prevent packing; most of the fine passes off with 500 to 1000 c.c. of water, but it is best to let 2 liters flow through. Then allow the remaining material to settle a few seconds, rinse into an evaporating dish or casserole, decant off water, wash twice with a little alcohol, dry and weigh the residue. This may be tested with 100- and 200-mesh sieves, if not sifted before making the test, and further examined with the microscope.

By commencing the test with a velocity of say 0.8 cm. per second, and repeating with the same material at 1 and 1.2 cm., several distinct fractions may be obtained from the material passing 200 mesh. The comparatively coarse particles are of several kinds: (1) Impurities, usually chips or sand. (2) Round particles of zinc, or aggregate made up of round particles, looking like grape shot. (3) Feathery or fernlike aggregates of minute crystals of zinc, often forming thin platy masses.

A separation of the coarse particles can, of course, be more simply made by repeatedly stirring with water in a beaker and decanting, but it is impossible to obtain comparable results unless a constant upward velocity is maintained in some such way as indicated.

Zinc Dust Microscopically Examined

The accompanying figures illustrate some of the variations shown in the appearance of certain samples of zinc dust when examined under the microscope. The following is a description of the samples examined: (1) Imported (German) zinc dust, satisfactory, precipitation good. (2) Imported (German) zinc dust, unsatisfactory, precipitation not good. (3) Domestic (U. S.) zinc dust, satisfactory, precipitation good. (4) Granular zinc. (5) Zinc filings, passed 200 mesh. (6)

Zinc shaving, extra fine, about $^1/_{50}$ in. wide.

The figures in the upper row, highly magnified, show the appearance of the medium portion of the "through 200" fractions of three such samples, the very finest part (under $\frac{1}{20,000}$ in.) having been removed by elutriation. As may be seen, these are almost perfect sphericles, and under the highest powers appear to have clean smooth surfaces, and to consist of nearly pure metal. The coarser particles, over 0.003 in. remaining on a 200-mesh sieve, are shown below, and vary greatly in appearance. In several of the more satisfactory samples, illustrated by Nos. 1 and 3, many of these larger particles have a rough, coke-like surface, but some generally exhibit branching crystalline, fern-like aggregates, and other aggregates resembling miniature bunches of grapes. It is possibly only a coincidence that the unsatisfactory sample (No. 2) had an unusually large proportion of the fern-like forms, and also showed more relatively large sphericles in the "through 200" portion. The extreme minuteness of the fine is shown by comparison with the equally magnified filing (No. 5) which had passed a 200-mesh sieve, and the granulated zinc, also passing 200 mesh (4A), the method of preparation of which is not known, but which had a very low precipitating efficiency.

Surface Exposed by Zinc Dust

As the efficiency of this precipitate is mainly due to its fine division or extended surface, some calculations of the latter may be of interest. To calculate the surface exposed by zinc dust, we may make use of the fact that the total surface exposed by one ton (2000 lb.) of any material in uniform grains, either cubes or spheres, is $\frac{2304}{gd}$ sq.ft., g being the specific gravity of the material and d being either the edge of the cube or the diameter of the sphere, expressed in inches. Hence, the density of zinc being very nearly 7, assuming it to be in the form of spheres of a uniform diameter of d inch, we have: Square feet surface exposed by 1 lb. $= \frac{0.165}{d}$.

Thus the portion which will *just* pass a 200-mesh ($d = 0.003$ in.) sieve will expose only 55 sq.ft. per lb., while the material averaging only 0.0001 in. in diameter, which constitutes a considerable proportion of the whole, as may be seen by a microscopic examination of the finer portion, exposes 1650 sq.ft. per lb. It is interesting to compare this with zinc shavings. If we assume this material to consist of a continuous rectangular strip, of width a and thickness b, we have:

Area exposed by 1 lb. zinc shavings $= 0.055 \left(\frac{1}{a} + \frac{1}{b}\right)$ sq.ft. If, instead of being rectangular, the cross-section of the shaving is a parallelogram of angle A, the above expression must be multiplied by cosec A; in this case the thickness b is measured at right angles to the width a.

For instance, with shavings $^1/_{32}$ in. wide, and of various thicknesses, the surface exposed would be:

Thickness	$\frac{1}{500}$	$\frac{1}{1000}$	$\frac{1}{1500}$ in.
Sq.ft. per pound	45.8	56.8	84.3

The number of particles (spheres) of zinc dust in a pound, assuming the specific gravity as 7, is $\frac{7{\cdot}544}{d^3}$. Hence, if the diameter is 0.001 in., 1 lb. will contain 7544 million particles, while at an average diameter of 0.0005 in., there will be eight times as many. This enables us to get some idea as to the intimate nature of the mixture obtained if an "emulsion" of zinc dust is prepared by distributing it with absolute uniformity through the solution to be precipitated. Suppose $^1/_5$ lb. of zinc dust is used per fluid ton (55,296 cu.in.) of solution, or 1 in 10,000 parts by weight, the diameter of the particles being taken as 0.001 in. From the above figures it appears that each cubic inch will contain about 27,300 particles, if uniformly distributed, whence the average distance between the particles will be approximately $^1/_{20}$ in. If the particles are half this diameter and equally distributed, there will be eight times as many to the cubic inch, and half the distance apart.

All samples shown in the upper row are highly magnified (see scale); those marked *A* are carried off by a stream of water rising 1 cm. per sec., but the finest dust has been removed. Those marked *B* remain on a 200-mesh sieve, and are less magnified.

Murray's Results Discussed

The foregoing notes were just ready for mailing, when I read a communication[4] from M. Thornton Murray, on the same subject. The sample of zinc dust examined by him appears to have been somewhat coarser than the average, as it is usual to find in the material of less than 0.003 in. diameter a good deal of dust not over 0.0001 in. diameter, and some considerably finer, so that I should be disposed to consider 0.0005 in. more nearly an average for this fraction.

Mr. Murray's assumed gravity (6.92) would give $\frac{0.1665}{d}$ instead of $\frac{0.165}{d}$, which I have assumed for the square feet per pound, or approximately 1% more surface than my formula would indicate. Thus, instead of 144.8 sq.ft. per lb., as calculated by him for a mean diameter of 0.00115 in., my formula gives 143.5 sq.ft. Actually I have found a range from 6.82 to 7 in the specific gravity of samples of zinc dust tested.

Mr. Murray has, however, seemingly obtained his "mean diameter" by multiplying the assumed diameter of each of his fractions by its percentage weight, and dividing the sum of these products by 100, which is not mathematically correct, for the reason that there are far more particles in 1% of the finer grades than in 1% of the coarse[5], if we consider a given weight of the total material. This makes his calculated mean diameter somewhat too high, and the resulting surface correspondingly too low. This may be seen by computing the surface for each fraction separately, as shown in the accompanying table, from Mr. Murray's data for percentages and diameters of the various fractions, the finest fraction alone giving a larger surface than he has computed for the whole.

SURFACE EXPOSED CALCULATED FROM MURRAY'S DATA

Fraction between	Mean Diameter of Fraction (d Inch)	Sq.Ft. for 1 Lb. of Fraction $0.165 \div d$	Per Cent. of Fraction	Sq.Ft. for 1 Lb. of Total Zinc	Sq.Ft. for 0.90 Lb. Metallic Zinc
0.0197 & 0.0100	0.149	11.07	0.16	0.018	0.0162
0.0100 & 0.0060	0.008	20.63	2.42	0.05	0.045
0.0060 & 0.0030	0.0045	36.67	2.88	0.106	0.0954
0.0030 & 0.0	0.00085	194.1	95.54	183.50	165.15
Total	0.0009*	183.67	100.00	183.674	165.3

*Approximate true mean diameter calculated back from total surface by formula ($0.165 \div d$ = sq.ft per lb.).

If the average diameter of the particles in the finest fraction be assumed at 0.0005 in. instead of 0.00085, the surface becomes approximately 330 sq.ft. for each pound of that grade, or 312 sq.ft. for a pound of the total dust, or about 288 sq.ft. of zinc, reckoning 90% of metallic zinc, the surfaces exposed by the coarser fractions being negligible in comparison. As others have pointed out in a previous discussion in fine grinding[6], the results of the calculation depend almost entirely upon the average diameter assumed for the material passing the finest sieve used, which we have no means of precisely determining.

[4]Journ. Chem., Met. and Min. Soc. of South Africa, October, 1911.

[5]This is obvious from a consideration of an extreme case. Suppose a mixture of equal weights of bullets of two sizes, half the weight being balls of 1 in. diameter, and half of 0.10 in. The mean diameter is not 0.55 in., since for every 1-in. ball there are 1000 balls of a diameter of 0.10 in.

[6]Journ. Chem., Met. and Min. Soc. of South Africa, Vol. VII, pp. 120, 207, 265, 289.

Baltic Method of Mining—III

By Claude T. Rice

In addition to being comparatively safe the method of caving the floor pillars yields remarkably cheap ore. Exploration is done cheaply. A disadvantage in the method is the tendency to maintain stopes that in reality are unprofitable. Much dead work is necessary. Tonnage per man is watched closely.

The most distinctive feature of the Baltic system is the method of mining the level pillar with a systematic recovery of the ore. A back of ore 60 ft. high is sometimes caved, but it is not good practice to cave a pillar this high, as the back is likely to become bad before the miners can take the top round off the next slice. The fact that the walls along these caves are not prospected, is no great disadvantage because this has been done on the level above and also in the stope at the bottom of the pillar block.

Method Safe and Cheap

The great advantage of the system is, that practically all the ore in the pillar block is obtained safely and cheaply, the ore from the cave being some of the cheapest procured in the mine. Sometimes a back of ore only 20 ft. deep is caved, but that is not good practice either, as it is too thin a block and too little advantage is taken of the cheap filling feature of the caving. Practice has shown that in this ground the most efficient caving height is that which will permit five or six rounds to be taken off before reaching the brow to be blasted with uppers. This makes the bar to be drawn, about 35 ft. thick, as the holes are drilled as half uppers, about 7 ft. deep in most of this pillar mining, or caving. Caving is done retreating from the boundary, or from the middle of a block between two shafts. Sometimes a small stope is carried up with its back at an angle of about 40°, approximating the slope of the caved filling, to come later. Such a stope may be carried up to within about 15 ft. of the level and then a raise put through to the level above; if the stope is short of filling, a raise may be put up from the top of the main stope without any upward slicing, for then filling can be dumped in from above, having been obtained by breaking into the gob on that level or else from some of the development workings. In any case, great care is taken not to damage the walls when breaking through. A feeling hole is first put up, and the place where that hole breaks through is noted. By placing the other holes with reference to that one, the raise is drilled so as to break through in the center between the walls.

Before blasting, the wall pieces on the level above are braced in order to take as much of the weight of the filling from the walls as possible, so that the whole level will not come down into the stope below, in case the walls are injured by the blasting. Spreaders and planks are also used to brace these walls, for it is highly desirable to keep them in perfect condition, until caving really commences. When the raise has broken through either the rilling off of a stope with the back having an angle of about 40° begins from the bottom of the raise, or, if the raise has broken through from the top of the stope, waste is dumped in to enable the miners to get up to the roof to drill the back, it being understood, of course, that the ore has all been sorted out and only poor rock left in the stope. After this is done, the stope is ready for caving.

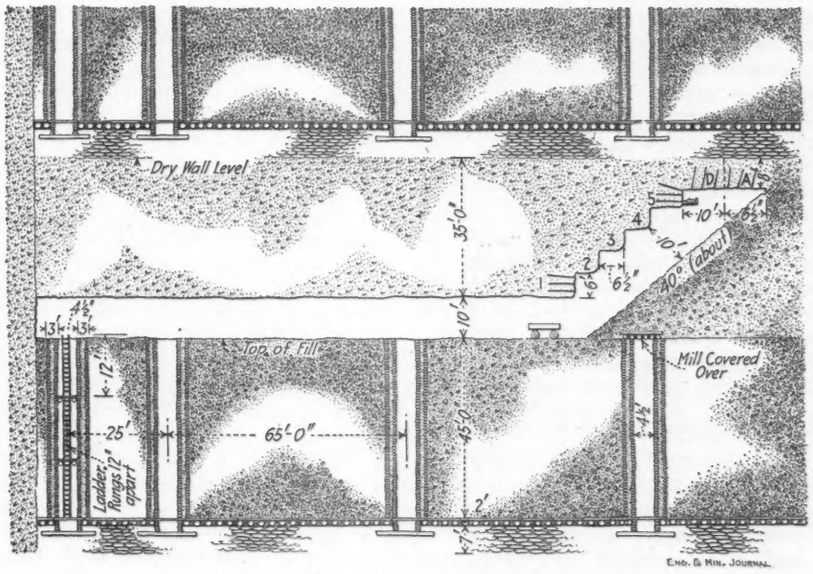


Fig. 1. Caving with Flat Holes, Baltic Method

Drilling in the "Cave"

There are two ways of doing the caving. The older one is still used at the Trimountain and is shown in Fig. 1. In this method, the ore is broken down by flat water and dry holes, just as in the regular stoping, except that the roof is carried up in a series of stepped breasts. In the newer and safer method, the roof is drilled with uppers as shown in Fig. 2. Where the lode is narrow and the back is not broken much, the method of carrying the stope up in a series of flat breasts with flat holes, is better, as the holes break a larger tonnage and less carrying around of the machine is necessary. A difficulty with this method is, that in bad ground the machines must be set up under an old back. If this back is broken much, considerable barring down will be necessary, and the jar of the machine is likely to bring down bad ground.

Where upper holes are used in this work, the machine is always set under a fresh back of ground that has not had time to become bad. The barring down of bad ground, necessary in this method, is no greater than in ordinary stoping operations. Where uppers are used only two breasts really have to be trimmed, the back under the last round blasted, under which the machine is set up; and the back ahead, under the round that is to be drilled. These two places must be trimmed up carefully. In the other methods with the flat-hole pillar stope, the machine is set up ahead of the breast that is being drilled, and four breasts must be trimmed carefully before drilling commences: The back over the last round blasted, the back under the one being drilled, the back of the bench under which the machine is being set up and the back of the bench above.

More Tonnage with Flat Holes

This may seem to be an unimportant matter, but it is really the thing that decides which of the two systems of drilling the cave shall be used. To sum up, the main reason that the benching system with its flat holes is used is, that

more tonnage can be broken in this ground with flat holes than with the same footage distributed in half uppers. The question then arises: Will the time taken in barring down the back, be sufficient for the drilling of enough uppers to give the tonnage that could be secured by flat holes in the same stope? Strange to say, it is safer to use upper holes.

Upper holes shake up a back more than flat holes do, because the breaking of the ground at the bottom of the upper holes causes more of a kick on the ore left on the back. It is not the kick of the hole that makes the ground bad in these caves so much as it is the time that the undercut back is left hanging, for upon that depends the extent to which the old slips and cracks that are formed in the level pillars will open up. It is this that really causes the dangerous ground in the pillar stopes.

The fact is important, that only about half as much back has to be trimmed each time in a cave worked with uppers as in one where flat holes are used; this is important in regard to the thickness of the level pillar that can be mined as well as because of the safety attending the use of upper holes. The sooner the machines get to drilling, the sooner is the slice carried up to the top of the pillar stope and a new slice begun. The time that it takes to work one of these slices determines the thickness of the level pillar that can be caved. As this is cheap ore it is highly important to increase its thickness to a maximum. In bad ground, drilling with uppers allows this to be done. It is the time that it takes to work a slice up to the pillar stope, which determines what the mine captains call the "handiness" of the cave.

Important Features of Pillar Mining

The essence of the pillar mining is to carry the pillar stopes up at an angle approximating that assumed by the filling when it runs down into the stope, and to leave an overhanging brow at the top of the pillar stope, to hold back the filling, permitting it to run down just near enough to the roof to permit the miners to set up and bar down the inclined back of ore easily. After the miners, with the machine set on top of the ore, have worked up another slice of the stope to add new width to the brow under the level above, and after the ore has been worked down from the pile of filling, enough of the brow is blasted to permit the filling to run down, in this way enabling the men to get near enough to the back to take another slice.

As soon as the raise has broken through, waste is run in so that the miners can get within set-up distance of the back and the stope at the bottom of the raise is worked up until it has assumed a slope of about 45°. Several slices are then worked off the sloping face, and waste is dumped in from above as fast as the ore is taken from the stope below. The cuts are carried up until an overhanging brow about 18 ft. long and 8 ft. thick has been formed under the level. The stope is then ready to be caved. This is generally done by drilling the brow from above. From 20 to 30 holes are drilled, so as to blast out all of the brow except about 8 ft. next to the face of the stope. This permits the filling from the level above to run down into the stope below and to fill it up to within about 6 or 7 ft. vertically of the roof.

Filling Is Held Back

Owing to the overhanging brow the filling cannot run down far enough to fill in next to the roof completely. As was mentioned before, the length of the brow at the top is regulated so that it holds the filling back just far enough away from the roof to permit the men to set up their machines. This is one of the features of the pillar mining. At the Baltic mine it is customary to blast out the wall pieces of the dry walls, so as to be sure that the filling will come down in good shape and not be hung up. At the Champion and the Trimountain, this is done only when starting the cave. Owing to the shock of so many holes going at one time, and the fact that the holes are drilled so as to break the roof from under the walls and make a wide hole, no trouble is experienced in making the walls fall in; strangely enough, however, there is no collapsing of the dry walls farther back, as they are generally found standing in good condition within 4 or 5 ft. from the brow of the cave.

At the Trimountain mine, I believe all the drilling for bringing on the cave is done from the stope below, but in both the Baltic and the Champion mines the procedure is as I have outlined. After caving has once started, the back part of the overhanging brow that is left to protect the stope from a deluge of filling, is always drilled before the front part is blasted; it would be unsafe to set up and drill the front of the brow after it has been standing for a long time, drilled and exposed to the hammer of the filling, as it runs down into the stope below.

Mixing of the Ore with the Filling

The theory is that the ore from this brow comes down ahead of the filling, in fact that it is pushed down ahead of it. I have not been in a stope just after the back has been blasted and the filling permitted to run, but I estimate that probably not over half of this ore in the blasted brow is recovered. Before the brow is blasted, all the ore has been cleaned from the top of the pile of filling in the stope, the pickers and the miners working the ore that is lying on the pile near the top, down to the bottom where it is thrown directly into the mill or loaded into a car and run to the mills when the latter are too far away. Most of the ore, however, runs to the bottom of the pile as it is worked away from the latter, for the filling on which the ore falls is just at the angle of repose.

The large pieces of the filling run down first and in case the small material does not come down of its own accord, the miners and pickers work it down so as to decrease the amount of ore that is lost through mixture with the waste, but there is almost always plenty of small dirt at the top of the pile. It is easy to tell the fresh ore from the filling, owing to the partial decomposition of the latter, and it is probable that little ore is lost through mixture with the filling either in the main stopes or during caving. In the main stopes care is taken to get a good covering of fine material on the top of the filling before the ore is blasted down, for this carpeting of the pile with fine material makes the shoveling of the ore easier. There is, of course, some loss of the finest of the ore, but as some of the top layer of filling is always scooped up with the ore, this cannot amount to much, especially as the ore does not break fine.

Before commencing to drill in the cave, the miners try to block back the filling with pole lagging dug from the latter so that the filling will not run down on them. The pieces that are about to roll down of their own accord are then forced down by the miners. It is sometimes possible to climb through one of these caves, but commonly the cave blocks itself tightly, although there is enough open space in the pile to admit a fairly strong draft of air through the cave.

Working Cave Stope with Flat Holes

In Fig. 1 there is shown the method of carrying up the back when flat holes are used. The best practise is to use five of these breasts, and each of them is about 6 ft. high and 6½ ft. deep. The sketch represents conditions in the stope just before the brow is blasted. The brow, as will be seen, is composed of two parts. Part *A* is the portion left standing ready drilled from the last brow, while *D* is the portion that has just been drilled and is to be left standing to hold back the filling while the next slice is worked off the roof. It will also be noted that breast 5 stands drilled. This is drilled at the same time that *D* is, and the machines, posts, drills, etc., are left piled on drills that are sticking out of the holes of this breast. When the filling rushes into the stope it cannot reach brow *D* and the machine men can pull down their machines with which to drill at the bottom of the level block, as soon as they have worked down the loose boulders on the waste pile, and blasted

round 1 that has been left standing there.

Round 1 is left standing because the fill does not always run well and if it does not it is difficult to set up under 1. By leaving round 1 standing, the miners are always able to get a good start on slicing the back, for when 1 is blasted there is enough ore to set up on, to reach the breast. A new round 1 is then drilled and left standing, and finally the real working up of the roof to the brow, begins again with a round left standing always at *A*, 5 and 1 in the best practice.

It will also be noticed that in Fig. 1 the level is shown well along toward the end of caving operations, as the shaft pillar is only back about 125 ft. from the pillar stope. The reason can now be seen for putting up the first two mills so close together. In caving there must always be both a manway and an ore mill, or two mill holes, open. The caving is continued until the pile reaches the mill next to the manway mill, the first one out from the shaft pillar. After a little horizontal slicing, the rest of the level pillar is left as a projection shooting out from the shaft pillar, possibly later to be obtained when that pillar is also robbed. Whenever the pile of filling is near the mill hole, the latter is covered over before the mill is run, for it is often possible to work back to the mill again by throwing some of the filling to one side.

Working Cave Stopes with Uppers

Fig. 2 shows the method of working the cave stope with half uppers. These holes are drilled 6½ to 7 ft. deep, and about parallel with the top of the pile of filling. About three holes are drilled to a row, and a block of ground about 6 ft. high and 8 ft. long, in the direction of the strike of the orebody, is broken. As shown in Fig. 2 the machine is set up on top of the pile of ore that has been blasted down by the last cut, rather than upon the filling. In Fig. 2, the machine men are drilling the top slice under the brow, it having taken them four such slices to reach that height. A round is left drilled at the bottom, but this is not so common a practice in the stopes drilled with uppers as it is in those drilled with flat holes, because the filling is always near the roof of the stopes in the caves drilled with upper holes. The brow, of course, is always left drilled as is the practice in the other systems. The other details of the work are quite similar to those in the other method of carrying up the cave stopes and do not require comment.

It would seem as though these cave stopes would be good places to use air-hammer stope drills, and a few are being tried. Their use saves much carrying around and the back can be drilled more easily, especially when it is broken up by slips; it is possible to set up the stoper drills any place and to drill away from under dangerous ground. In short, the air-hammer stoper drill is more mobile than a machine set up on a bar, as the set-up can be changed as desired and it is unnecessary to choose a set-up designed to last a day. Mobility is an important thing in drilling these caves.

Working Cave Stopes under Pillars

It will be seen, of course, that an essential in this so called caving, is the pile of filling to set up on. In case there is a pillar of poor ground along the level above, little trouble is experienced, provided the poor ground is not long. At the Trimountain and the Champion mines, however, where the patches of poor ground are generally longer than at the Baltic, considerable trouble has been experienced in working cave stopes

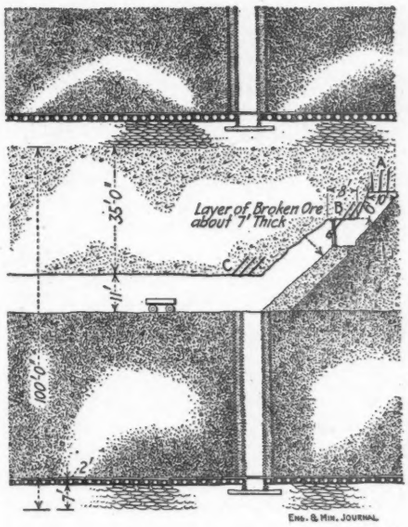


Fig. 2. Caving with Upper Holes, Baltic Method

under them. In such a case it is cheaper in the long run to stope up through the pillar and to tap the filling in the stope above the pillar. This is done by continuing past the level with a small inclined stope, until the drill hole that is carried ahead in the breast, as a precaution, goes into the filling. This inclined stope is then enlarged until the blasting of the back will make a hole large enough to permit the filling to run down through it freely. The floor of this stope, of course, is carried up sufficienly steep so that the broken rock will run by itself.

It may be necessary, temporarily, to carry the roof of the cave stope clear up to the top of the poor patch of ground, leaving a brow to hold back the filling, as in robbing the level pillar. Once the connection has been made, so as to get enough filling down to fill the stope, mining can generally progress with the top of the stope at the level, as before the poor pillar was encountered. The length of the poor patch, as well as the amount of poor rock from the level pillar itself, determines this.

Both in the caves and the regular stoping, the ore breaks large and many boulders have to be broken up to get them into the mills. This is sometimes done by pasters, but generally the boulder is blockholed instead of being bulldozed, as most of the machine men can double-jack a hole into a boulder in a short time. Formerly small air-hammer pluggers were used for drilling the boulders. In this event, however, a quantity of boulders would be blasted at once and it was not always possible to determine whether or not the holes had exploded. If there was a missed hole, this was attributed, after a short hunt for it, to two holes having gone at the same time. In time, however, it was discovered that more dynamite was being found in the rockhouse than before. Therefore, owing to the fact that it is necessary to drill the blockholes only 2 or 3 in. deep, to break up an ordinary boulder, there was little, if any saving in having a special man go through the stopes, drilling these pop-holes with a plugging drill, and the practice was discontinued.

Keeping Upper Stopes Filled

Owing to the continual pulling of the filling from the stopes above, to fill the top part of the stopes below, it is necessary, in order to prevent the caving of the surface, to dump in poor rock to take the place of the filling. However, it is considered that after a depth of 1000 or 1200 ft. vertically, has been reached, it will no longer be necessary to fill the upper stopes in this manner. After that the poor rock will be dumped underground only as the most convenient way to get rid of it. At present, however, this filling is supplied by dumping into the mines, the poor rock that is coming from the development work on the lower levels. At the Champion this is hoisted to surface and is there loaded into a car, after being dumped over the grizzley to screen out the fine material for road purposes, the oversize being run back into the mines. At the Trimountain mine this poor-rock dump is on the first level, while at No. 4 Baltic the stopes from surface down to the ninth level have been filled with poor rock dumped from surface; also from the ninth level to the 13th the stopes have been nearly filled by tramming the poor rock from the bin on the ninth level, into which the poor rock is dumped from the skips.

In order to permit this tramming of the poor rock out along the level, the stopes of the level below cannot be caved. Instead, that block of ground is sliced up close to the level and only enough of the back is left to secure the level above.

This floor pillar, however, is left only on a level where the lode is comparatively poor. Several raises are cut up through this level pillar, and as fast as the filling is drawn down more fill is dumped in. Owing to the dip of the lode it is generally feasible to work the filling down in this way for about five levels. Consequently, the poor-rock dump at that shaft is to be changed from the ninth to the 14th level.

This underground dumping of the skip is accomplished by raising the back wheels and dumping the load that way instead of cutting the rails and letting the front wheels of the skip drop away as is done in most of the skip dumps. The dump used at the Copper Range mines was devised locally and called the Angove dump after J. W. Angove, the master carpenter, who invented it.

Advantages and Disadvantages of the Method

In this method like any other where the back is not supported, the ore must be strong and not inclined to scale off badly, thus making it dangerous and requiring much barring down to make it safe for the pickers to work under. The pickers, of course, could be kept nearer the miners if desired, and the filling carried along contemporaneously with the mining, in parts where the poor rock from the lode is insufficient to fill the stope. This would remove, to a large extent, the trouble from the slabbing of the roof, but the ore must stand well. The walls can be weak for they are exposed only over short stretches. To use the dry walls the rock must break into long, flat boulders. A class of labor that is cheap and patient is also essential in this work. The rock should be fissile, so that it can be trimmed up to fit fairly tight in its place. The rock must not be much altered or it will crack in time, partly because of the weight on it and partly because of decomposition.

The method of mining the level pillar is adapted to the mining of any such pillars where the ground will stand in open stopes. The finer the filling that comes down from above and the more difference that there is in color as compared to the ore, the less will be the ore lost through admixture in the working of the pillar. The Baltic method possesses all the advantages that attend mining with a filling. The highest possible extraction is obtained by the method, and therefore the maximum production possible from a given area of ground, especially where irregular fingers break off into the walls, as at the Baltic. Any ground nearby, that is of mineable grade, can be worked cheaply, as the mining of the main lode has not broken up the ground in its vicinity. The walls can be explored cheaply, as the filling can be utilized in the stopes, and the necessity of getting filling encourages a thorough prospecting of the walls, a thing that often is much neglected in American mining. As stated before, enough copper is obtained by the exploration of the walls in this mine, in the opinion of those who know the mine best, to pay for the cost of the filling of the stopes.

Damage by Crushing Is Avoided

Because of the filling of the stopes, damage to the mine through crushing is avoided, and it is impossible for the cracking and caving of the walls and adjacent country to be serious. This is an important feature when working the mines at great depth and where the condition of the walls in the upper workings is important in keeping the shaft open. Within limits, there is a control over the grade of the ore that is sent out from the stope. This fact made the Baltic mine one of the lowest-cost mines,

DETAILED UNDERGROUND COSTS
BALTIC MINE FOR 1910

Tons of rock hoisted	823,352
Tons of rock stamped	781,419
Total shaft sinking	780.5 ft.
Total drifting	11,218 ft.
Total crosscutting	465 ft.
Percentage of waste hoisted to surface	5.09
	Costs per ton stamped
Underground superintendence	$0.015
Underground labor:	
Drillers	0.353
Trammers	0.194
Pickers	0.154
Fillers, all time on filling	0.023
Wallers	0.049
All other underground labor	0.051
Underground supplies:	
Explosives	0.077
Sunshine, carbide and candles	0.010
Timber	0.012
All other supplies	0.036
Compressors and drills	0.055
Hoisting expense	0.060
Rock house	0.047
General expense	0.043
Engineering and assaying	0.003
Office	0.020
Surface labor	0.010
Total cost of mining, per ton	$1.212

per pound of copper produced, of any in the United States, while it had been able only with difficulty to keep its head above water, when the method in which practically all the ore broken had to be sent to surface, was used. This underground sorting means success or failure at many mines.

The method of contemporaneous filling of the stope permits the sorting to be done at a minimum expense, and at the face, where the ore is fresh and the minerals keep their characteristic lustre, untarnished by exposure to the air. The disadvantage of the method is the difficulty of having the work done properly. The underground sorting requires constant watching and the back must be watched carefully to make the men keep it safe for the pickers when they follow along later. Bossing costs are, therefore, likely to be higher than in other systems, because it is necessary to watch the way the men do the work, rather than the quantity of work that they do. This has its advantages, however, in that the close watching necessary makes the work of the men more efficient. There is the drive of the work behind the men that there is not in ore-filled stoping methods. The pickers must fill the cars or it shows, and the miners must break the ground so that the pickers can have the dirt. The amount of work done shows quickly for each set of men.

Much Dead Work Necessary

A large amount of dead work is necessary so that the underground costs are always high, regardless of whether the fill comes from the lode, is sent down from surface, or is broken from the walls in prospecting, as is the case at the Baltic. Tonnage figures and costs are always against the mine using such a method, except in regard to cost of finished products, and that fact sometimes influences the choice of method. One of the greatest faults is the fact that it is easy to continue to work a stope after it really is failing to carry itself. Poor rock can be disposed of easily, the fall in tonnage figures is not especially noticeable, owing to the large amount of dead work that is done all the time, and unconsciously the tendency is to work for too long a time, ground that is below the border line of profit. In other words, there is a great temptation to prospect by stoping. Moreover, as it is so easy to dispose of the poor rock, since filling must be obtained for the stope, there is also a temptation to sort too clean.

While I have stated that it is difficult to make the men keep the workings safe, the method itself is intrinsically one of the safest. The important thing consists in making the bosses see, that when an accident occurs it is their fault, until they can show that they were not negligent in their inspection of the workings. In this method it is up to the boss as soon as there is an accident and the Copper Range mines are worked on this principle. That is one reason that there are so few accidents in the stopes and, in fact, throughout the whole mine.

Cost and Tonnage Statements

The following figures showing costs and tonnages have been compiled from the last three reports of the Copper Range companies for the Baltic and Champion mines. These properties are all on the same lode, and the extreme stopes in the extreme mines are not four miles apart; the mines are operated under the same management and even have the same general underground superintendent. The mining method is the same in all the three mines and the occurrence in a general way is similar except as to grade.

The conditions at the Baltic mine are more normal in regard to the method,

than at either the Champion, where the method has not been in use quite so long, or at the Trimountain, where a large amount of development has been necessary in the search for ore. I will give only detailed tonnage statements and detailed underground costs for the Baltic. These are higher than in the past, but are about what they will probably average at present, when all the work is properly proportioned. The company reports give only the general underground costs, but they are enough to show how these costs vary in mines even nearby and working under quite similar conditions.

AVERAGE COSTS AT COPPER RANGE MINES, 1908-09-10

	Costs per ton of rock stamped		
	Baltic	Tri-mountain	Champion
Rock hoisted, tons, total for three years	2,485,066	1,144,183	2,446,521
Rock stamped, tons, total for three years	2,359,796	975,636	2,280,662
Percentage waste	5.04	14.7	6.78
Shaft sinking, ft.	2,392.5	2,866	2,587
Drifting, ft.	31,320	24,167	35,306
Crosscutting, ft.	1,841	2,116	1,934
Mining Costs			
Superintendence and labor	$0.815	$1.014	$0.915
Rockhouse expense	0.057	0.074	0.057
Hoisting expense	0.063	0.136	0.054
Power drills and compressors	0.055	0.096	0.074
Powder and supplies	0.154	0.202	0.176
Surface Expenses			
Superintendence and labor	0.029	0.067	0.028
Supplies	0.017	0.020	0.012
Insurance	0.006	0.014	0.008
Purchasing department	0.003	0.005	0.004
Legal and general expenses	0.002	0.003	0.003
Teaming	.....	.....	0.003
Electric lights and telephones	.....	.....	0.001
Library maintenance	.....	.....	0.002
Transportation, rock to mill	0.142	0.113	0.138
Stamp-mill expense	0.187	0.202	0.194
Cost, exclusive of smelting and taxes	$1.510	$1.946	$1.669
Smelting, freight, marketing (variation entirely due to copper content of ore)	0.214	0.194	0.230
Total cost per ton, exclusive of taxes	$1.724	$2.140	$1.899

At the Baltic mine the tonnage of stamp rock obtained per man underground was 2.8 tons per shift during 1910. In that year there was obtained per man at surface and underground at the mine 2.48 tons per shift and in 1909 the figure was 2.62 tons. In 1910 there was sent to the mill 2.26 tons per man employed at the mine and the mill while in 1909 the corresponding figure was 2.39 tons. During 1910, 5.09% of poor rock was hoisted to surface, and in 1909 this figure was 4.34 per cent.

TONNAGE PER MAN WATCHED CLOSELY

The tonnage obtained per man in the cave stopes is about 10.5 tons in the Baltic, 9.75 at the Champion and 6.75 at the Trimountain under present conditions. When the tonnage gets down to five tons per man working in the cave, the cave is watched carefully as it is about at the border line between profit and loss. These tonnage statements and the tonnage per man employed are the two statements that the management watches the closest in the operation of the mine, as the number of men at surface is practically constant and there is no necessity for keeping a separate statement of the tonnage per man underground. Any variation in the tonnage for them shows immediately in the other statement and investigation begins.

Taking the average of the underground labor costs for three years at the Baltic and adding, from the surface costs statement, the cost of surface labor and of supplies, and assuming that the cost of purchasing the mine supplies about balances the mill's proportion of the cost of the accounting for the property, all of which I have included in the mine costs, I find that the total mining cost was $1.19 per ton while the cost for underground labor and superintendence was 81½c. per ton, or 68½% of the total mining cost, being somewhat higher in proportion than in other mining methods because of underground sorting and the fact that by dry-walling the levels, the cost of supplies is decreased at the expense of labor cost. Only in 1908 was a separate construction account kept. It amounted to $99,035 for the three properties. The cost for the three mines, therefore, gives the total cost of producing the copper except that I have not included taxes.

In conclusion, I wish to acknowledge the kindness of F. W. Denton, general manager; W. H. Schacht, assistant manager; John Jolly, underground superintendent for the Copper Range Consolidated, as well as the captains of the different properties, for the information so kindly given during the preparation of these articles.

Queensland 1911 Mineral Production

The advance sheets of the report on the mineral production of Queensland (*Queensland Government Min. Journ.*, Mar. 15, 1912) for 1911, show the following figures: Gold, 386,164 oz., £1,640,323; silver, 549,015 oz., £56,305; copper, 20,383 long tons, £1,151,351; coal, 891,568 tons, £323,998; tin concentrate, 3091 tons, £307,847; wolfram ore, 539 tons, £54,163; limestone, 114,675 tons, £27,887; gems, £27,393; lead, 1771 tons, £23,460; molybdenite, 99½ tons, £13,278; bismuth and wolfram ore, 129 tons, £11,564; iron flux, 20,639 tons, £11,157; miscellaneous items, £12,337; a total of £3,661,063. This is a decrease of £49,159 from the previous year. The gold production decreased £234,627, but other metals and minerals showed slight increases.

Standard Consolidated Mining Co.

The operations of the Standard Consolidated Mining Co. at Bodie, Calif., as shown by the official report for the year ended Jan. 31, 1912, were carried on under adverse conditions. The development work of 6254 ft. was done at the relatively high cost of $4.28 per foot and the amount of ore disclosed was comparatively small. The ore obtained by development was 1486 wet tons and by stoping 7980 tons, giving a total mined of 9466 wet tons or 8798 dry tons, which was insufficient to keep the mill operating at full capacity and resulted in higher costs.

The average grade of this ore was $14.74, of which 45.8% was recovered by amalgamation in the mill. In the slimes plant, the tailings from the stamp mill together with 15,917 tons from the pond, making a total of 24,715 tons averaging $5.73 per ton, were cyanided, the indicated extraction being 86.8% and the actual recovery 128.6%. The total indicated extraction was 90.7%, while the actual extraction was 117.1%. Superintendent Buchanan thinks that this discrepancy between indicated and actual recovery may be due to the presence of amalgam in the old tailings, as the bottoms of several of the ponds were worked out during the year. Due to the small tonnage available from the mine and the difficulty of handling the old tailings, which are practically all clay, and filter slowly, the total tonnage was much less than last year and the cost per ton higher.

The total cost of all operations is given as $17.107 per ton, divided as follows: Mine: General, $3.614; development, $2.827; stoping, $4.362; distribution accounts, $0.978; total, $11.781 per ton. Mill: Labor, 89.6c.; supplies, 33c.; bullion (express and treatment), 6.9c.; distribution accounts, 58.3c.; total, $1.878. Slimes plant: Labor, 93.6c.; supplies, 91.6c.; bullion, 7.8c.; distribution accounts, 46.5c.; total, $2.395. Administration, $1.053. The following additional data concerning supplies consumed in the slimes plant are given: Cyanide, 1.1 lb.; lime, 16.6 lb.; lead acetate, 0.1 lb.; zinc, 0.7 lb.; pebbles, 0.9 lb. per ton of ore.

South Australian 1910 Mineral Production

The mineral production of South Australia for 1910 is officially reported as follows: Copper, 5102 long tons; gold, 6603 oz.; salt, 54,000 tons; iron ore, 46,200 tons. The copper production is valued at £306,120, the other three together at £76,945, while the remaining mineral production is valued at £32,777, of which gypsum, £9000, and bluestone, £5980, are by far the largest items.

Breaking of the Gold Cliff Hoist Cable

By Lewis H. Eddy

The breaking of the winze hoist cable and the dropping of a loaded skip to the bottom of the 900-ft. winze in the Gold Cliff mine, in Calaveras County, Calif., about the middle of February, attracted little attention, owing to the absence of injury to any of the workmen, and to the slight damage to the underground equipment. The Gold Cliff is one of the Utica Mining Co. mines, at Angels Camp. It is situated about half a mile southwest from the Utica and Stickels mines, which are owned and operated by this company within the town of Angels. It is entirely separate and without underground connection with the other workings.

A Utica Mining Co. Mine

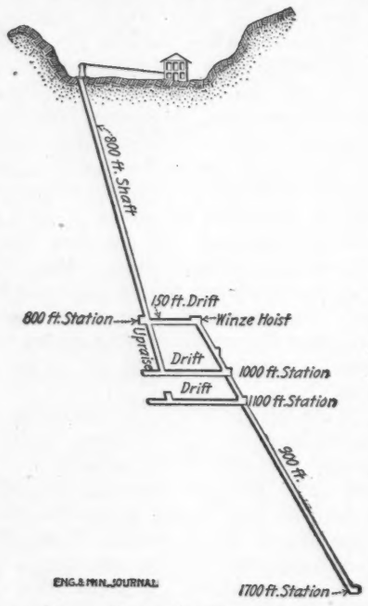
Economically, it is a part of the Utica system and is operated under the direction of the same superintendent, F. J. Martin. The mechanical operation is controlled from the same source. The 60-stamp mill, which crushes the ores from the Stickels and the Cross shaft of the Utica, and the 40-stamp mill, which crushes the ore from the Gold Cliff, receive electric power from the same station, as do the hoists; the compressors are under one roof; the plants are situated at Angels. The operation of each mine is separately controlled; an accident in one cannot affect another.

The trend of the Gold Cliff veins is about northeast; the dip varies from 28° to 60°. The mine is developed by inclined shaft and winze, drifts, crosscuts and raises. The shaft is 800 ft. inclined depth from the collar to the first station; thence a drift is run 150 ft., from which point the winze starts; the winze is about 900 ft. deep from the mouth to the lowest station. At 200 ft. below the mouth of the winze, a station is cut and a drift run toward the shaft; this drift is connected to the shaft by a raise. Another station is cut at 300 ft. below the mouth of the winze, and a drift run toward the shaft; a raise has been started to connect this drift with the first raise. Other drifts from the winze will be run and all will be connected by raises; thus deepening the shaft by raise connections until it reaches the lowest level of the winze.

The ore is mined in the drifts, crosscuts and raises and the bottom of the winze. There are five stations: One shaft station for loading, at the 800-ft. level; one hoist station at the mouth of the winze on the 800-ft. level; two intermediate stations at the 1000- and 1100-ft. levels (in the winze), and one at the 1700-ft. level, the bottom station in the winze. There are two electric hoists: One at the surface, which raises the ore from the 800-ft. level; one at the mouth of the winze, which raises the ore from the lower winze levels. The ore is trammed from the unloading station at the mouth of the winze to the loading station at the shaft. When the shaft is deepened by connecting raises until it reaches the lowest level of the winze, the ore will all be raised to the surface through the shaft by one hoist.

Hoist Cable in Winze Broke

The accident in February resulted in damaging the timbers in the 1100- and 1700-ft. stations. The men in the drifts climbed ladders to the 800-ft. level, and were then lifted in the usual way in skips through the shaft to the surface. The cable parted at a point nearly 300 ft. from the reel, the loaded skip striking the 1100-ft. station, and then going direct to the bottom of the winze. The cable had been in use about six months. It was a



Gold Cliff Mine, Angels Camp, Calif.

⅞-in. cable, the same size and make as used in all the Utica workings, and by the records of the life of other cables should have been good for two years' wear. The skips in the Gold Cliff carry one ton; in the other Utica workings the skips are 1½-ton capacity.

Examination of the broken parts of the cable disclosed some of the center strands corroded and so brittle as to be easily broken with the fingers. Other parts of the cable were cut in the examination and were found to be sound. Black crude oil was used for "doping" or coating this cable, and is the same coating that was and is used on all the cables in the Utica mines, and the same as is used in general practice in this part of the state. The cost of a new cable was the only significant item of expense resulting from the accident. The repair of the damaged stations caused only a short delay and the cost was nominal.

Nevada Consolidated

The report of the Nevada Consolidated Copper Co. for the quarter ended Mar. 31, 1912, shows production as follows: January, 6,309,228 lb.; February, 4,888,790; March, 6,380,432; total, 17,578,450 lb. The low production in February was due to the extremely dry season. Additional settling reservoirs have now been built, so that the concentrator water can be used again when necessary.

Ore milled amounted to 728,592 tons, averaging 1.85% copper, of which 76,547 tons were mined by underground methods from the Veteran mine. After paying the regular quarterly dividend, and charging off depreciation on the Steptoe plant, and ore extinguishment, the balance to undivided profits for the quarter was $212,479.

A contract has been drawn by which one section, or one-eighth of the Steptoe concentrator, will be used hereafter for ore from the Giroux Consolidated Mines Co. The remaining seven sections should be ample for the Nevada Consolidated output. This contract runs for five years, but can be cancelled at any time on one year's notice.

Tennessee Copper Co.

The operations of the Tennessee Copper Co., at Copperhill, Tenn., for 1911, showed a total profit of $407,049. This was not as satisfactory as had been hoped for, and was due to the low price of copper prevailing during the year, and to a fire in the acid plant in June, which damaged the flue connecting the smeltery and the acid plant, and the tops of the Glover towers. This necessitated a complete cessation of operations for over a month, and seriously impaired the efficiency for over two months.

Screens have been installed to get rid of excessively fine material in the blast furnaces. This was necessitated by the enlarged acid-plant capacity, which required that the gas from all the furnaces should be available for acid making. This screening and the bedding plant have permitted cutting off about 20% of carbonaceous fuel, giving more SO_2 in the flue gases, while the acid plant itself has been efficient beyond the early estimates, so that production now is at the rate of about 200,000 tons per year. The fines themselves, with the flue dust, and some custom ore, are treated in a Dwight-Lloyd sintering plant.

Total copper production was 13,808,940 lb. from 436,285 tons of Tennessee company's ore, or 31.6 lb. copper per ton of ore, and 3,832,972 lb. of copper from 34,768 tons of custom ore, or 110.2 lb. copper per ton of ore. Total costs at Copperhill were $0.09599 per lb. of copper, or $3.03772 per ton of Tennessee ore. This is distributed as follows: Mine

development, $0.15600; mining, $1.06599; railway, $0.08338; general expense, $0.12455; smelting, $1.38326; converting, $0.22454. Freight, commission, etc., bring these figures to $3.4428 per ton of ore, and 10.88c. per lb. of copper.

Mine development amounted to 3896 ft. of openings, and 1992 ft. of drilling. Ore production was 444,625 tons. Mining has been changed from underhand to back stoping.

Proposed Tariff Legislation

WASHINGTON CORRESPONDENCE

Senator A. B. Cummins of Iowa has offered in the Senate a new bill amending the metal schedule. This bill, presented on April 29, has been examined by experts in the employ of the Democrats of the Senate and is approved by them. The plan as now framed is to start a debate on steel and other metals at once, carry it along until concluded and then insist upon a vote on the Democratic steel bill. This will be defeated. Then reconsideration will be moved and the new Cummins measure will be substituted for the Democratic bill and passed, if enough insurgent Republican votes can be secured, as it now seems probable they can. In that event the Cummins bill will meet the House Democratic metal bill in conference and whatever may be determined upon will be between the two measures. Then presumably this compromise will be passed through both Houses and sent to the President. The Cummins bill contains among others the following provisions:

(1) Iron ore, including manganiferous iron ore and the residuum from burnt pyrites, shall be admitted free of duty.

(2) In this act a ton shall be held to mean 2000 lb. except with respect to pig iron, spiegeleisen and ferromanganese, and as to them 2240 lb. shall be considered as a ton.

(3) Iron in pigs, iron kentledge, spiegeleisen and ferromanganese $1 per ton; cast and wrought, scrap iron and scrap steel, fit only for remanufacture by melting, 50c. per ton.

[Steel ingots and other more advanced forms are to enter under duties ranging from $1.60 to $5 per ton.]

(43) Lead-bearing ore of all kinds, 1.5c. per lb. on the lead contained therein; Provided, that on all importations of lead-bearing ore the duty shall be estimated at the port of entry and a bond given in double the amount of such estimated duties for the transportation of the ores by common carriers bonded for the transportation of appraised or unappraised merchandise to properly equipped sampling and smelting establishments whether designated as bonded warehouses or otherwise. On the arrival of the ores at such establishments they shall be sampled according to commercial methods under the supervision of Government officers, who shall be stationed at such establishments, and who shall submit the samples thus obtained to a Government assayer, designated by the Secretary of the Treasury, who shall make a proper assay of the sample and report the result to the proper customs officers, and the import entries shall be liquidated thereon, except in case of ores that shall be removed to a bonded warehouse to be refined for exportation as provided by law. And the Secretary of the Treasury is authorized to make all necessary regulations to enforce the provisions of this paragraph.

(44) Lead dross, lead bullion, or base bullion, lead in pigs, and bars, lead in any form not specially provided for herein, old refuse lead run into blocks and bars, and old scrap lead fit only to be remanufactured, all the foregoing 1.875c. per lb.; lead in sheets, pipe, shot, glaziers lead and lead wire, 2.125c. per pound.

(45) Zinc-bearing ore of all kinds, including calamine containing less than 10% zinc, shall be admitted free of duty; containing 10% or more of zinc and less than 20%, 0.25c. per pound on the zinc contained therein; containing 20% or more of zinc and less than 25%, 0.5c. per pound on the zinc contained therein; containing 25% of zinc or more, 1c. per pound on the zinc contained therein; Provided, that on all importations of zinc-bearing ores the procedure shall be the same as with lead ores.

(46) Zinc in blocks or pigs, and zinc dust, 1.25c. per lb.; in sheets, 1.5c. per lb.; in sheets coated or plated with nickel or other metal, or solutions, 1.625c. per lb.; old and worn-out zinc, fit only to be remanufactured, 0.875c. per pound.

(47) Aluminum, aluminum scrap, and alloys of any kind in which aluminum is the component material of chief value, in crude form, 6c. per lb.; in plates, sheets, bars and rods, 9c. per lb; barium, calcium, magnesium, sodium and potassium, and alloys of which said metals are the component material of chief value, 2c. per lb., and 20% *ad valorem*.

(48) Antimony as regulus or metal 1c. per pound.

(49) Chrome or chromium metal, ferrochrome or ferrochromium, ferromolybdenum, ferrophosphorous, ferrotitanium, ferrotungsten, ferrovanadium, molybdenum, titanium, tantalum, tungsten, or wolfram metal, and ferrosilicon, 15% *ad valorem*..

(50) Nickel, nickel oxide, alloy of any kind in which nickel is the component material of chief value, in pigs, ingots, bars, rods, or plates, 4c. per lb.; sheets or strips, 25% *ad valorem*.

(51) Copper, in rolled plates and various manufactured forms, 1 to 1.5c. per pound.

(52) Antimony ore, stibnite and matte containing antimony but not containing more than 10% of lead, 0.75c. per lb. on the antimony contents therein contained; the procedure as to assay, etc., to be substantially the same as with lead. Antimony oxide to pay 1.25c. per lb. and 20% *ad valorem*.

(53) Metallic mineral substances in a crude state, but not including ores herein specifically described or producing metals upon which a duty is herein laid, and metals unwrought whether capable of being wrought or not and not otherwise provided for herein, 15% *ad valorem*.

(54) Monazite sand and thorite 3c. per lb.; thorium oxide of and salts of, gas mantles treated with chemicals or metallic oxides, and gas mantle scraps consisting in chief value of metallic oxides, 30% *ad valorem*.

Mortality of Tropical Natives in Rand Mines

JOHANNESBURG CORRESPONDENCE

In a recent debate in Parliament, the minister of native labor made some startling statements regarding the importation of natives from tropical regions in South Africa for work on the Rand. He stated that there were 25,000 such natives at work, and that the mortality was such that for years a situation had existed which could only have existed because of a cynical disregard of human life and of ordinary humanity.

A year ago the mortality on one mine was 391 per 1000 per annum and many mines showed a mortality of over 100. Since then, owing to warnings from the government, an improvement has taken place, the average rate now being 70 per 1000 against an average of 22 per 1000 for all natives employed. Several groups, however, still show far too high a mortality, up to 269 per 1000, and the government has warned the Chamber of Mines that tropical natives must not be supplied to mines showing a bad record or the whole importation scheme will be stopped.

The mortality among the natives from British Nyassaland Protectorate is still so high (279 per 1000) that these natives will no longer be allowed to be imported. Pneumonia is the main cause of the high death rate and the Chamber of Mines recently brought out Sir Almroth Wright, one of the authorities on inoculation, to ascertain if it is not possible to establish some scheme of inoculation against this disease.

Puzzolan cement, as now understood, is the product resulting from mixing and grinding together in definite proportions, slaked lime and granulated blast-furnace slag or natural puzzolanic matter, such as puzzolan, santorin earth, or trass obtained from volcanic tufa.

PERSONALS

Mining and metallurgical engineers are invited to keep The Engineering and Mining Journal informed of their movements and appointments.

Fred Hellmann has gone to California from the Joplin district.

Kirby Thomas has returned to New York from Joplin, Mo., and the Arkansas zinc field.

E. Z. Burns, of Simonds & Burns, New York, has left for Colorado and Nevada on professional business.

Hamilton & Hansell announce that from May 1, their offices are in the Hudson Terminal Building, 50 Church St., New York.

Capt. Joseph Hodgson, of Ishpeming, Mich., has been appointed superintendent of the Copper Queen mine, at Bisbee, Arizona.

F. F. Sharpless, who has been in Missouri on professional business, returned to New York this week and then proceeded to the Pacific Coast.

Ernest H. York has been appointed manager of the Hughes Property, at Porcupine, Ont. He was formerly with the Calcite Lake mine, at Gowganda.

Grenville Chapman, recently of El Paso, Tex., has removed to Miami, Okla., where he will have charge of one of the Chapman & Lennon zinc properties.

Henry P. Brown is the master appointed by the United States Circuit Court to take testimony in the suit against the United States Steel Corporation.

John D. Ryan and the party which accompanied him, have returned to New York from their trip to the West, which included Michigan, Montana and Arizona.

Charles Botsford, recently in Mexico, is now at Houghton, Mich., for the General Development Co., making a geological map of the Naumkeag copper property.

Edmund Putnam, formerly operating at Parral, Chihuahua, Mexico, is at Boston. He will return to El Paso, Tex., and make headquarters there until the Mexican situation changes.

William Crosley, for some years in Mexico as field engineer for some English interests, is now in London, and will leave there for the Gold Coast, West Africa. He expects to return to Mexico about the end of the year.

Henry Leighton, instructor in mining geology at the School of Mines, University of Pittsburg, has been promoted to be assistant professor of economic geology, and will have charge of the departments of economic geology and of ceramics.

S. H. Hamilton has terminated his engagement with the Manatawny Bessemer Ore Co., and is no longer in charge of its prospects, in Berks County, Penn. He is now at Ringwood Manor, N. J., and is engaged in making magnetometric surveys to delineate lenses of magnetite in the Archean rocks of the Highlands of New Jersey.

Charles E. Knox, president and general manager of the Montana-Tonopah Mining Co., accompanied by Edgar Collins, who recently arrived from South Africa, has gone to Pearce, Ariz. Mr. Collins, who for a number of years has been connected with the company, will assume charge of the Commonwealth mine at Pierce, which was recently purchased by the Montana-Tonopah.

John Jermain Porter has resigned from the University of Cincinnati, and after June 1 will devote his entire time to consulting practice as metallurgical engineer. Mr. Porter will make his headquarters at Staunton, Va., and will give especial attention to improving the operating efficiency of blast furnace, foundry, coking and other processes. In this work he will be associated with Charles Catlett, consulting economic engineer, of Staunton, whose strong connections with the Southern iron industry are well known.

OBITUARY

Donald M. Scott died at Laurium, Mich., Apr. 29, aged 50 years. He was born in England and educated as a civil engineer. He went to the Michigan copper country 15 years ago, and had been employed at several mines, besides acting as village engineer at Red Jacket and Laurium.

John Wesley Pullman died at his home at Wyncote, May 5, aged 73 years. He was born in New York, being a grandson of Peter Cooper, and graduated from the College of the City of New York. He was connected with the Cooper Union industrial school for several years and afterward with Cooper, Hewitt & Co. in the iron business. Later he established an iron-ore business in Philadelphia, which he conducted for many years.

Societies and Technical Schools

New York Academy of Sciences—At the regular meeting of the Section of Geology and Mineralogy, on May 6, Alfred H. Brooks, of the U. S. Geological Survey, delivered a lecture on the "Geology and Mineral Resources of Alaska;" illustrated with lantern slides, maps and charts.

University of Illinois—The senior and junior students in the Department of Mining Engineering have recently visited the Illinois Steel Co.'s plant, at Joliet, the mines, zinc works and cement plants in the La Salle district of Illinois, and a number of manufacturing plants in Chicago, where mining machinery is made; also the accounting offices of a number of the larger mining companies, having headquarters in Chicago.

American Institute of Metals—The name of the American Brass Founders' Association, by an overwhelming vote of its membership, has been changed to the American Institute of Metals. In addition, a change in the by-laws has been made which provides that the institute shall meet in convention each year at the time and place selected by the executive committee, instead of the time and place chosen for the annual convention of the American Foundrymen's Association. The Institute will hold its annual meeting in Buffalo during the week of Sept. 23, next.

University of Missouri—Owing to the continued demand for mining students, mine managers and superintendents, graduates and undergraduates of engineering schools, and science teachers, the School of Mines and Metallurgy announces a six-weeks' summer school, beginning June 3, 1912. All of the courses will be given in the laboratories at Rolla. The following courses will be given during the 1912 summer session: Fire Assaying; Qualitative Chemical Analysis; Quantitative Chemical Analysis; Slag Analysis; Mining; Metallurgy Laboratory; Cyaniding; Cyaniding Laboratory.

International Association for Testing Materials—The Organizing Committee announces that the sixth congress will be held at the Engineering Societies Building, New York, Sept. 2-7. After the opening general meeting, the members will be divided into sections, which will hold their annual meetings separately.

The technical proceedings of the congress will be unusually valuable. The list of papers announced is unprecedentedly large and excellent; over 150 reports and papers are in hand or promised. Nearly one-half of them have been already received and are being printed, and the others are to follow shortly. About 35 American papers are included in the list. It is desired that the discussion of the papers and reports may be full and thorough, within the necessarily limited time of the sessions. With this in view, it is urged that discussion be prepared in advance of the congress, when references, figures and similar material are available for citation. Discussion prepared in advance and submitted in writing will have precedence over impromptu discussion. The advance distribution of the printed papers will give opportunity for preparing discussion. For earlier information, however, short abstracts of the foreign papers are being obtained as far as possible, for publication. The secretary of the committee is H. F. J. Porter, whose office is at No. 1 Madison Square, New York.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

May 1—The farmers of Shasta County are still disinclined to allow the Balaklala smelting operations to be resumed, and are disposed to demand further accounting from the Mammoth smeltery. The recent offer of the Balaklala to pay such damages as might be awarded by a commission to be appointed, one member of the U. S. Circuit Court, one by the farmers and one by the Balaklala, was rejected by a meeting of the farmers, on Apr. 27. The rejection was not positive. The farmers are watching the progress of thiogen tests. A majority of the members of the farmers association were in favor of instituting legal proceedings against the Mammoth, but the president of the association reminded the members that it will cost money to carry on a legal fight, and that the association is still in debt to the attorney who represented the farmers in their fight with the Balaklala. The meeting concluded without decision as to paying out more money.

Rain and snow have been general recently throughout the northern and some of the Mother Lode counties. The outlook for water for mining purposes is encouraging, though there is still some fear expressed that there will be a shortage before the season is ended.

Reports from New Pine Creek state that a number of mining men have arrived there from California, Nevada, Utah and Colorado, with the purpose of investigating the Highgrade camp. The men interested in prospects in Highgrade are principally Colorado men. Some interests have been purchased by Los Angeles and Salt Lake mining men. The new properties have not attracted a great deal of attention in San Francisco. Should the camp be a large prospective producer, capital will be obtained easily in San Francisco, but there is an impression obtaining that a good deal of the talk about the Highgrade district, and a portion of the rush, has been the result of the extension of the Nevada-California-Oregon R.R. from Alturas by way of Davis Creek and across the Oregon line to the town of New Pine Creek. So far as geological indications go, the gold-bearing rocks are more generally sought in the vicinity of Fort Bidwell. That district is about 20 miles southeast of New Pine Creek, and on the California side of the line. The new Highgrade district extends from a point between Mount Bidwell and Goose Lake northerly across the line, and to the neighborhood of New Pine Creek. The larger portion of the town and also of the mining district is on the California side of the line. The railroad connections by way of Reno being the most direct route, the district is more likely to receive its greatest attention from Denver and Salt Lake than from San Francisco.

Butte

May 1—Plans are being perfected for developing water power at Thompson Falls, on the Clark's Fork of the Columbia River, in Sanders County. A large dam will be constructed, and power and electric light furnished to the entire county, and to the Cœur d'Alene mines. Work will be started soon on the erection of an auxiliary power plant on Prospect Creek, near-by, to furnish power to drive the machinery used in building the dam. The temporary plant has been designed to furnish about 1000 hp. and the equipment for its construction is now on the road from the East. The work is under the supervision of Engineer George H. Potter, and he will have men employed in building the auxiliary power house and flume within a week. The enterprise is being promoted by Senator Donlan and it is estimated that over $2,000,000 will be expended on the work in the next two years.

The electrification of the Butte, Anaconda & Pacific R.R. between Butte and Anaconda has been commenced, and within a year, passenger and ore trains will be hauled with electric power. The electric motors to be used will be of the same type as those in use at the terminals of the New York Central Lines in New York. Work on the extension of the road from Anaconda to Georgetown is well under way with 300 men engaged in grading, and the new wagon road at Silver Lake is nearing completion. It has been reported unofficially that plans are under consideration for the further extension of the road from Georgetown to Phillipsburg.

The Magone and Anderson group of claims in the Garnet placer district consists of four claims, the Magone and Anderson, Lide, Nancy Hanks and Adlia, partially developed by three tunnels, two of which are being used. About 400 ft. of drifting have been done from the upper tunnel, and a body of ore opened for 300 ft. The upper and lower tunnels have been connected by a raise on the vein, showing ore for 220 ft. Since taking over the property Colonel Peake has installed electric drills. The Mitchell and Mussigbrod group of claims, down the gulch from the Peake property, consists of 30 claims, on a number of which development work has been done, and ore worth nearly $800,000 mined in the last 12 years. The ore is treated in a 10-stamp mill on the property. Above the Peake property is the Ritchey group of 10 lode and several placer claims. The property has been developed by tunneling and considerable ore mined. A tunnel is now being driven to tap the vein at 200 ft., and it is planned to use this as the tramway for the ore to the millsite, 2000 ft. distant.

Denver

May 2—Owners, leasers and miners in the Cripple Creek district have all been making more money during the last three months, and in April, 2000 tons more were produced than in March, the total output for last month being 77,281 tons with a total value of $1,216,693, against $1,140,900 in March. It is said that many of the large companies are leasing their best orebodies at high royalties, as they have found their profits are greater by this method than if worked on company account. Of course, the leaser works more economically and is more careful of the ore than the day's-pay miner, and moreover pays no salaries or office rent. In addition to this, the companies are leasing all the ground they cannot operate profitably on company account.

Better prices for tungsten ore are now coming, as the Primos company announces in its new schedule, with rates as follows: $3.50 per unit for 10%, $4.40 for 20% and $4.90 for 40% ore. This company will start its Lakewood mill soon. The Colorado Tungsten Co. will start its new concentrating plant in about a month, and the Boulder Tungsten Production Co., with J. C. Clark at the head, is planning extensive development in the district.

In the Silverton district, work has been resumed in the Copper Bell mine, in Whitehead Gulch, under the direction of J. H. Harrington. The officers of the Vermilion Mining Co. are expected to arrive from Cleveland, Ohio, next week, to make arrangements for the active working of the property this summer. The Congress mine is under lease to the Southern Exploration Co., which is cross-

cutting from the shaft on a small vein of ore, and drifting toward the main orebody. Truman Taylor is overhauling and testing the Silver Lake mill, with a view to making a better saving. The Ross Mining & Milling Co. has put 20 men at work on the Champion mine.

In the Telluride district, at a meeting of the Wild Boy Mining & Milling Co., J. M. Wardlaw, of Denver, was elected president, and W. M. Harrington, mine superintendent. The purchase of a mill was authorized and the superintendent instructed to start its erection as soon as the snow goes off. The Wild Boy mine is on Silver Mountain, between the Suffolk and the Alta & Gold King. The Morning Star Mining Co. will build a mill this season and treat the dump ores while developing the reserves. The company has water power, and an air compressor on the ground, which will be installed soon, and the property worked under the management of W. R. Vanderveer. At the Lewis mine, Manager Livermore has a force of men at work on development and sinking a main shaft.

Salt Lake City

May 2—Much interest is being taken in the visit here of John D. Ryan, who has been making a trip through the Northwest with a party of Eastern men. The party arrived in Salt Lake City from Montana, May 1, visiting the International smeltery, at Tooele, earlier in the day, and in the evening attending a banquet given in their honor at the Hotel Utah by Col. D. C. Jackling, vice-president and general manager of the Utah Copper Co. In a speech at the banquet, Mr. Ryan expressed confidence in the resources of the State of Utah as a field for investment, and paid a tribute to the work of Colonel Jackling. Mr. Ryan said in part: "This state was made before we saw it, and its resources are not excelled by any state in the entire union. The agricultural, mineral and other resources have hardly been touched and the era of mighty progression is just dawning. Colonel Jackling is a splendid illustration of the man from out of the West, who has demonstrated to the Eastern financier that his money is more than safe in the mining industry. Jackling has taken the hills and stripped them of their wealth, and is adding to the commerce of the world and state more than the early pioneers could ever dream of existing here."

Owing to a strike of the unskilled foreign workmen demanding an increase in wages, the Murray plant of the American Smelting & Refining Co. has practically closed down, pending a settlement, the only work done being that of keeping the furnaces in blast. Although the strikers are quiet and no trouble is expected, 10 deputy sheriffs have been sent to Garfield as a precautionary measure.

Joplin, Mo.

May 2—If any outsider ventured to comment critically on the methods or practice of the operations in southwest Missouri, he has usually been effectually silenced by flaunting the fact of the low-grade records of the district, and any expressions of surprise as to technique or equipment have been complacently received by the local operators. The fact of the low costs is to be admitted, but it should also be admitted that it is due largely to exceptionally favorable operating and economic factors and in the light of modern critical investigation of technical and business operations, it is probable that the low-cost boast and the complacency will both be disturbed.

Recently there has been a realization of the possibilities of improvement in local mining practice, and there is a probability that many of the cherished operating traditions of the district may soon pass. The small "tub" and the inadequate pumps; the single shaft and the aversion to precautions for safety, may soon all be reminiscences. Perhaps the fee owner may also be jarred loose from his medieval and often suicidal royalty demands. These changes are partly due to natural evolution and somewhat to an infusion of outside ideas, but it is admitted among the Joplin operators themselves that a change is working and for progress.

Toronto

May 3—Final action has been taken by the bondholders of the Amalgamated Asbestos Corporation, representing $6,500,000 of bonds, in connection with a slight modification of the plan suggested by the general committee for the reorganization of the company.

The resolution, which was unanimously approved, provides that out of the total authorized bond issue of $5,000,000, bonds to the par value of $3,000,000 be issued and that the total authorized issue of common stock be increased from $2,875,000 to $3,000,000, the difference between these amounts and the amounts suggested in the original plan, being authorized to provide for the payment of certain outstanding liabilities of the Amalgamated Corporation.

Cobalt

May 3—The work of preparing for the new addition to the Northern Customs Concentrator is being pushed as rapidly as possible and it is expected that the new machinery will be in operation in August. The addition will consist of 40 stamps and will cost approximately $75,000. When completed this will be the largest stamp mill in Canada. The increase in capacity was necessitated by the increased production of the different mines which are under contract, the only new ore being that of the Drummond mine.

Porcupine

May 3—At the time of the Porcupine fire, last July, a considerable sum of money was raised for the purpose of establishing a hospital for the miners of the district. The Relief Committee of the Toronto Board of Trade set aside $10,000 for this purpose, but on account of the difficulty of agreeing on a site, no action has been taken until quite recently. The Toronto Board sent a representative to the district to come to a final settlement, and a site has been chosen on Porcupine Lake, halfway between Golden City and South Porcupine. This matter has caused considerable dissatisfaction among the mine managers, who would have preferred a different site. In the Pearl Lake section, the old Bewick-Moreing clubhouse is being converted into a hospital to serve the residents of that section, while the Dome already has a completely equipped hospital.

Johannesburg

Apr. 1—The former general manager of the East Rand Proprietary Mines is being prosecuted for sending in false returns of gold obtained from mill and cyanide plants from 1909 to 1911. The present manager has reduced the tonnage milled per month from 200,000 tons to 144,200 and is milling ore above the average grade of the mine, the grade recovered being 33s. per ton, but the cost was raised to 22s. 8d. per ton. The proportion of payable ore to total ore exposed in the lower levels at this cost figure, will be only about 20 to 30%. At the yearly meeting of the company, the chairman was reëlected but the real control has now passed to the "Corner House" or "Eckstein" group. Awkward questions were skilfully dealt with regarding past management and the future prospects were declared to be encouraging.

Trouble is apparently brewing at the other end of the Reef. Numerous dismissals and changes of management have taken place recently. The controller of this group, Sir John Robinson, has always pursued a somewhat secret policy, and shareholders are alarmed because one shaft has already been closed down, presumably owing to the low-grade ore met with; it is freely rumored that the recent estimates of ore reserves are wrong, that there is no chance of the mine keeping 1000 heads of stamps employed, that probably the four old 100-stamp mills on the south section will be closed down and that all milling work will be concentrated on the large 600-stamp mill, of which so far, only about 300 stamps have been kept running. The closing down of the other mills will mean much unemployment and should the mine not come up to expectation, it will be another severe disappointment and will engender mistrust.

The Mining News

The Current History of Mining

Arizona

Cochise County

Shattuck-Arizona—It is reported that the directors have decided to build a 400-ton smeltery, probably at Douglas, Arizona.

Gila County

Warrior—A suit has been filed by the Warrior Copper Co., of Philadelphia, against the Warrior Development Co., of Duluth, and its president, Henry B. Hovland, asking $69,000 damages, and an auditing of the books. The Warrior Development Co., in October, 1909, acquired from the Warrior Copper Co., under a three-year bond and lease, the Black Warrior mine, northeast of Miami, and operated it until 1911, when the mine was closed down and relinquished to the owners. Before closing down, the shipments to the El Paso smeltery averaged 100 tons of copper silicate ore per day, assaying about 10% copper. The complaint alleges: That the mine was gutted, wrecked and left in dangerous condition, many of the workings being rendered useless and inaccessible; that false reports of the money received for ores had been made to the plaintiff company; that careless management and neglect had caused the loss by fire of a leaching mill, worth $25,000; that taxes had not been paid as the statements showed; and other serious charges.

Inspiration Consolidated—The survey for the possible site for the concentrator on Salt River, has been completed, and the engineers are engaged in surveying the Black Warrior camp site, north of Miami, for the same purpose. At the Inspiration mine, a small force has been put to work underground, and this will be gradually increased. The Joe Bush shaft has been equipped with skips and underground ore pockets and will be working soon. The 10x16-in., double-drum hoist at the Colorado shaft is being moved to the Scorpion shaft, which is 275 ft. deep and will be sunk by contract an additional 220 ft. Another 150-hp. boiler will be added to the power-house equipment at the portal of the main tunnel. At the Live Oak, the boilers have been blown in at No. 2 shaft, and sinking has been resumed. The shaft will be sunk from its present depth of 928 ft. to over 1100 ft. No. 1 shaft, now 470 ft. deep, will also be sunk an additional 180 ft. Men are repairing the road from the Inspiration mine office to the Warrior camp site.

Barney—Churn-drill hole No. 2 has been discontinued at a depth of 600 ft., and from now on only one machine will be used. This machine is at present working on hole No. 3, being drilled jointly with the Live Oak and Southwestern Miami companies, and has not yet passed through the Gila conglomerate.

Southwestern Miami—Holes 4, 5 and 6 are still in the conglomerate formation, and it will be six or eight weeks before any important developments may be expected.

South Live Oak—The machinery and supplies are beginning to arrive at Miami and are being hauled to the company's property, three miles west of Miami, where churn-drilling will soon be started.

Keystone—It is rumored that negotiations are in progress for the acquisition by the Inspiration Consolidated company of this mine, which lies between the Inspiration and Live Oak, on the basis of 3,000,000 tons of developed ore.

Castle Dome—L. D. McClure, manager for the South Live Oak Development Co., has secured for the men who promoted that company, an option on the Virginia or Castle Dome group of 35 claims, six miles northwest of Miami, on Porphyry Mountain. They are traversed by numerous faults and fracture zones, showing considerable iron and copper staining, and it is proposed to explore them by churn drilling.

Arkansas

Baxter County

A project to install a hydro-electric plant on the White River, at Cotter, is being financed by Henry L. Doherty & Co., of New York. Congress has granted the franchise and surveys have been made. This will supply cheap power to the zinc districts of northern Arkansas. Another project on the White River, near Hollster, Mo., will furnish power for several of the Missouri districts.

Marion County

Morning Star—Development will be continued and operations resumed at this zinc mine in the Rush Creek area, south of Yellville. The property has a 150-ton mill, but is not extensively developed. S. A. Hazelbaker is manager.

Iola—This zinc mine, north of Zinc, has been taken under bond by Clay Gregory, of Joplin, and associates. It has a 125-ton mill and is opened by a tunnel.

California

Amador County

The suit of Morris Jones, a farmer, who complained that the tailings from the quartz mines and the débris from the dumps had injured his land, is reported to have been settled by Jones filing a perpetual easement to the Kennedy, Argonaut and Zeila mining companies, giving use of his land.

Butte County

Oro Electric Corporation—This company, successor to the Oro Water, Light & Power Co., has placed $3,500,000 bonds on the market for the development of power projects. The company operates two hydro-electric plants with combined capacity of 4000 hp. It furnishes power to dredges, and has interests in dredge operations in Butte and Calaveras Counties.

California Extraction Co.—This company has announced that it will install two machines for the extraction of gold from the black sands in the dredge tailings.

Calaveras County

Surveyors are running lines for a new railroad, between Valley Spring and Rich Gulch, *via* Mokelumne Hill. If constructed, the road will open a marble quarry. There are also asbestos deposits in the vicinity.

Stocktonia—This is a new mining company, with head offices at Stockton, organized to develop a graphite deposit near Campo Seco. The capital stock is $25,000. The directors are: W. E. Stewart, R. H. Stewart, James Baker, F. E. Holton and T. A. Jordon.

Kern County

A part of the placer ground, recently acquired by Sidney Couburn, between Randsburg and Atolia, has been taken over by Charles Phelps, who will incorporate a company to work the placers with the process owned by the Gold & Platinum Extraction Co. A 1400-lb. test mill is to be employed for prospecting purposes, and a test run of 30 days will be made. If successful, a larger plant will be installed.

Buick Oil Co.—The suit of Ralph Arnold, formerly of the U. S. Geological Survey, for one-fourth interest in the 3,000,000 shares of stock of this company, is reported to have been settled by compromise.

Santa Barbara County

Western Gasoline Co.—The plant is operating to full capacity in the extraction of gasoline from natural gas on the Hall property. The result is about 300 gal. of gasoline from about 400,000 cu.ft. of gas. The gasoline is high gravity and commands a ready market. The New Pennsylvania also has a supply of gas which is furnished to this company which will average about 1 gal. of gasoline per 1000 cu.ft. of gas.

Union—This company is planning for the installation of a gasoline plant. One well on the Hobbs lease is reported to be good for 3 gal. of gasoline per 1000 cu.ft. of gas.

San Bernardino County

Considerable activity is being displayed in the Kramer-Barstow oil district. The Kramer Consolidated well is down 2947 ft. The Barstow Paraffin will drill near Barstow. The North American Petroleum well is north of Kramer. Mallery & Hutchinson are north of Barstow. The Santa Fé R.R. is sinking a water well east of Mojave.

Shasta County

Northern California Power Co.—The power line from Kennett to the Uncle Sam mine, installed last winter by the Sacramento Valley Power Co., is being taken down. The Northern California has absorbed the Sacramento, and will maintain its own line.

Sierra County

Sierra Standard—A wagon road is being built to this property, in Sailor Ravine, five miles above Downieville. Jason S. Frye is superintendent.

Miller—These claims, at Loganville, adjoining the Hayes Consolidated property, have been taken over by the same company which has that property under bond. Thomas C. Heide is in charge of both properties and is preparing to handle all ores at the Hayes Consolidated mill.

Siskiyou County

Forks-of-Salmon—This company has installed a large elevator on the Salmon River placers and is said to be handling large quantities of good gravel.

Tuolumne County

Mammoth—The new electric motor has been received and work resumed at this mine, near Jacksonville. This is one of the old properties recently reopened. The development demanded putting in commission the 10-stamp mill formerly operated on ore from the Republican, which is one of the group now belonging to the Mammoth.

Neuebaumer—Grading for the installation of a 5-stamp mill is in progress at this mine, at Tuttletown. The property is reported to be showing well.

Colorado

Boulder County

Golden Age Mining & Reduction Co.—This new corporation backed by Eastern men, has taken over the Golden Age mine near Jimtown. Under A. H. Martin, general manager, a 50-ton cyanide mill will be built and the dump, estimated at 50,000 tons, will be treated. The mine will be unwatered and fully developed for production.

Clear Creek and Gilpin Counties

Colorado Central—Work will be resumed under the leasing system by the Clifford Exploration Co., at favorable terms to the leaser. The Marshall and the Ocean Wave tunnels will be put in good order and the 600-ft. shaft repaired. The Waldorf properties are to be leased in like manner by the same company. It is predicted that within 90 days 200 men will be at work on these properties.

Buckeye—Good ore has been opened in this mine on Quartz Hill by F. E. McCoy.

Phoenix-Burroughs—In the lateral being driven from the Newhouse tunnel to reach the main shaft, a body of heavy sulphide ore has been opened. The vein is 12 ft. wide.

Bates—A local pool has leased this mine in Chase Gulch and is unwatering the shaft. The mine has been idle for 20 years.

Cripple Creek District

Colorado King Gold Mining Co.—This new company has been incorporated to take over the Blanche and the Madeline companies. Stock will be exchanged share for share in the new company. A. E. Carlton, of Cripple Creek, is president.

Portland—Leases are being granted at the north end of the company's estate on Battle Mountain, by Manager Frank Smale.

Trilby—The main oreshoot has been opened in a crosscut from the 1100 level, and has been leased to Oleson & Van Tilborg of Cripple Creek. The output is expected to reach 50 cars of mill ore per month.

Maggie—Carl Johnson, lessee, has sunk the shaft an additional 200 ft. and is drifting from the fifth level to get under the known orebodies.

C. K. & N.—Shipments of two cars per day are being made by the Rapp lease on the fifth level, and two other sets of lessees are making occasional shipments.

Stratton's Independence—During March, production totaled 3160 tons, averaging $19.04 per ton, and 10,500 tons of low-grade mine and dump ore were milled. The net working profit at both mine and mill was $18,250, and $1700 were spent on special development.

Gunnison County

There is a general talk throughout the district of replacing mules with mechanical haulage. Gasoline locomotives appear to be in some favor, especially if the exhaust can be properly controlled.

Belzora Bassick Mining & Milling Co.—It is reported that the company will install a mill this summer.

Gold Links Smelting & Mining Co.—The company may install a water-power plant this season, to develop a high-pressure current for use at the mines at Ohio City, seven miles distant.

Lake County-Leadville

Robert E. Lee—The lessees of this Fryer Hill mine are driving from the 500 level toward the Forest City where connection for air will be made.

Jonny No. 2—Shipments of medium-grade gold ore are going out steadily from the Barnes lease.

Hellena—The output of the experimental mill in Iowa gulch is about 45 tons per day and since the jigs have been repaired, the separation of the lead and zinc is said to be excellent.

Ella Beeler—The tunnel is in 785 ft. and 300 ft. of it are being retimbered by A. S. Sharp & Co., lessees. A stope is also being retimbered.

Elk—In this mine at the head of East 5th Street, the lessees have opened on the 225-ft. level 4 ft. of ore carrying lead and silver, and shipments to the smeltery are being made.

Luzerne—Good iron and silver ore is being shipped by Thomas Simpson & Co., lessees on this mine on East Fifth St. The lower levels will be prospected for carbonate-of-zinc ore.

Mineral County

Creede Mines Co.—The company will install a 30-hp. gasoline motor, weighing 9000 lb., about June 1. This motor is being designed by T. B. Humphrey, and will be built by the Vulcan Iron Works, of Denver.

Ouray County

Revenue Leasing Co.—This company has taken over under lease and option the entire property of the Revenue Tunnel Mines Co. Five subleases are being operated. Development of the Cumberland mine will be confined to drifting on two levels and raising to develop orebodies. A. G. Suydam is superintendent, at Sneffels.

Atlas Mining & Milling Co.—The company will soon change the present jig-back tramway to the Bleichert system. After the change it will be possible to hand-sort the coarse material sent to the mill with the elimination of both waste and ore of shipping grade, which now go together to the mill. Plans have been developed for increasing the mill capacity

by the installation of another 10-stamp battery, and for another similar increase at a later date. Fred Carrol is manager, at Sneffels.

Barstow—This mine, at Ironton, has been developing the orebody found last year. With the opening of the roads and a flow of water for milling, the ore above the second level will be explored. Sinking began May 1, to explore the ore below the second level.

Camp Bird—Opening of the new orebody for stoping is being pushed, and meanwhile only 20 stamps are dropping.

SAN MIGUEL COUNTY

Ophir Gold Mines, Milling & Power Co.—The experimental work relating to the installation of the cyanide process has been completed, and work on the 150-ton plant may start this month. The process will be all-slime and agitation, followed by continuous decantation. A new adit level is being driven to the fifth-level workings, and will be equipped with electric traction.

Tomboy—During April, 9200 tons of ore were crushed, yielding a profit of $32,000; expenses were $43,500 and $3595 were spent on permanent improvement.

Idaho

COEUR D'ALENE DISTRICT

Silver Cable—The lower tunnel has been driven through the vein which showed about 4 ft. of low-grade milling ore where it was cut. This is satisfactory to the company, for in the upper workings, directly above this place, there is no ore. Drifting has started along the vein and in the short distance driven the ore has improved.

Caledonia—The orebody has been found in the drift from the raise opened from the lower tunnel. The ore contains principally wire silver, carbonates of copper and lead. The copper will average about 18% throughout the orebody already opened.

Cedar Creek—Some good samples of galena were brought in recently from this property. The samples were fine grained and soft. The shaft is down 100 ft. and work is still in progress. There is at present plenty of water for power and it is not likely that there will be any delays on account of water shortage.

Bear Top-Orofino—Since October, 1911, the company has shipped 26 cars of ore. One shipment of approximately 38 tons of concentrates, gross, assayed 5.15 oz. silver and 68% lead per ton. Freight and treatment charges were $12 per ton, and the net value $39.84 per ton, with a total net value of $1161. The company has a 125-ton mill, which is stated to be doing good work and all ore is run through. About 400 tons of concentrates per month are being produced and these are hauled three miles to the railroad. The shipping point is Bear Siding, one mile from Murray. Charles N. Mundell is secretary and B. G. Harmon mine superintendent.

Michigan

COPPER

Calumet & Hecla—The company has begun excavation for the addition to the electric power plant. The building will be extended about 80 ft. to accommodate the new 7500-kw., mixed-pressure steam turbine and auxiliary apparatus. This company has also started the driving of piles for the foundations for the new regrinding plant. There will be installed in this mill 64 conical tube mills for the grinding of the sand, together with their supplements of concentrating tables.

Algomah—No. 7 drill hole has encountered a copper-bearing formation at a depth of about 1000 ft. It is of good character and well mineralized. The crosscut from the 200-ft. level of the shaft is driving in the direction of this lode and is about 75 ft. from it. The lode is believed to be the same as that cut by holes Nos. 1 and 2 some time ago.

Adventure—Further developments on the lode that was cut unexpectedly by the crosscut from No. 5 shaft, continue to show copper in commercial quantities. Should this lode continue, this property can be put on a producing basis in a much shorter time than any of the newer companies, owing to the fact that it has a complete equipment at the old workings and a stamp mill that could be put in condition with comparatively little outlay. Developments are being watched with much interest.

Oneco—The shaft is over 1200 ft. deep and should cut the lode at about 1225 ft. When this is done, opening will be started from the 9th, 10th and 11th levels.

Copper Range—The company will extend its underground electric traction equipment and has purchased five 4-ton G. E. trolley locomotives.

IRON

Jones & Laughlin—At the Lake Angeline mine, in Ishpeming, ore is being forwarded from stockpile by steam shovel, and the Rolling Mill mine, at Negaunee, is shipping ore from the pocket at shaft No. 1; shaft No. 2 is now enlarged and timbered for over 330 ft. of the 620 ft. to the first level.

Negaunee—After three years of preparation, shaft No. 3 has started hoisting.

Oliver—On the Marquette Range, shipments are going forward from the Hard Ore and the Section 16 mines, at Ishpeming. At Negaunee, the Blue and the Prince of Wales, of the Queen group, are shipping. In the Gwinn district, the Stegmiller is shipping.

Champion—This old hard-ore mine of the Oliver company, at Champion, has been closed down and will be allowed to fill. The mine was opened in 1867, and has shipped ore every year since then, its total production being about 4,500,000 tons of high-grade, non-bessemer ore. The greatest vertical depth is 2300 feet.

Ravenna—At this M. A. Hanna exploration, in the Crystal Falls district, considerable ore is reported to have been found. The property is west of the Bristol mine, and the ore is similar to the large orebody of the latter. A shaft has been put down southwest of the Bristol and drifting on the 250-ft. level is in progress. The equipment is small and underground exploration will probably be continued.

Newport—This large mine, at Ironwood, owned by Ferdinand Schlessinger, of Milwaukee, is reported to have sold 1,000,000 tons of ore. A large quantity is in stock and it is not likely that the force of men will be increased.

Hiawatha—This Rogers-Brown mine, at Iron River, is shipping from the stockpile by steam shovel. The equipment is in good shape, and Capt. Bert Baumgartner is in charge underground.

Bristol—This mine, of Oglebay, Norton & Co., is unable to ship because of the cave-in, which wrecked the siding which served the property.

Hollister—This M. A. Hanna & Co. mine in the Crystal Falls district has been closed and the pumps pulled. The ore in stock will be shipped this season, but it is doubtful if the lease will be renewed. The ore contains a large percentage of moisture and a drying plant was installed in 1911 by G. C. Olmsted with a capacity of 300 tons per 24 hr.; the ore was dried by hot gases in an inclined revolving drum.

Montana

BUTTE DISTRICT

Butte-Alex Scott—The mine is shipping, at present, about 200 tons of ore per day to the East Butte smeltery, and on this basis of production, reserves are said to be sufficient to last for some years of continuous operation, without regard to future development work. In drifting on the 1000-ft. level, a body of first-class copper ore, 4 ft. wide and carrying good gold and silver contents, was recently encountered. It has been recommended by President N. F. Hugo that the payment of dividends be begun this year.

Butte & Superior—The new concentrator at the property is nearly completed. Ore crushing has started at the shaft collar and the concentrator bins are being filled. The capacity of the plant is expected to be about 1000 tons of ore per day, producing about 400 tons of concentrates per 24 hours.

Elm Orlu—Dispatches state that Senator Clark will build a concentrator three miles south of Butte on the Milwaukee

railroad, and that a milling company with a capital of $100,000 was incorporated, May 2, for this purpose.

North Butte—Most of the high-grade ore being shipped now from the Speculator mine is being mined from the Snowball and Berlin veins. The Adirondack vein is becoming a promising orebody and has increased in width and grade with depth. On the 2200-ft. level the orebody averages about 6% copper and 7 oz. of silver per ton for a width of seven feet.

Pilot-Butte—The Pilot shaft is about 1000 ft. deep and will be sunk to the 2000-ft. level before a stop is made. The Snowball and Berlin veins have been developed by the North Butte company nearly to the end line of the Pilot property, and it is expected that they will be found in the Pilot. The mine will probably be in the producing class within a year.

Broadwater County

The mines engaged in active mining and shipping in the Radersburg district are as follows: Butte & Radersburg, Keating, Ohio-Keating, Black Friday and Bonita; with the completion of the branch of the Milwaukee railroad from Three Forks to the camp, many of the properties will double their output.

Butte & Radersburg—An air compressor was installed recently, and the entire equipment has been modernized. An orebody, carrying good lead, gold and silver ore has been opened. A vein was encountered in sinking the shaft, and at 140 ft. had a width of 4.5 ft. and carried good gold and silver contents.

Gallatin County

Spring Hill—Active development work will start soon at this mine, near Manhattan. The work is to be under the direction of Richard Trevethick, a Butte mining man, who will arrive soon. The property is owned principally by Manhattan men.

Granite County

American Gem Mining Syndicate—Work is expected to start soon at the sapphire mines of this company, near Phillipsburg. Joseph Sorenson has arrived from San Diego, Calif., to take charge of the work.

Madison County

During the last week, negotiations have been closed for several properties adjacent to Virginia City, and the prospects are good for a prosperous season there. Mining men have lately been looking over the ground with the idea, it is rumored, of erecting a custom mill. Such a mill would be of great benefit to the district, as there are many low-grade mines, which need a cheap method of ore treatment to make them steady producers.

Bell—Mr. Bell, of Virginia City, has sold to S. J. Bukvich, of Butte, property consisting of the Bell mine and a one-half interest in the Grand Union and Bell Fraction mines, three miles from Virginia City, in Alder Gulch. A large amount of low-grade milling ore is available, and the new owner is endeavoring to obtain a lease on the Grant mill. If unable to do this, Mr. Bukvich plans to erect his own 15-stamp mill.

Easton—Plans are being made to remodel the concentrating plant on this property, owned by Mr. Elling, of Virginia City, and to double its present capacity. J. H. Pankey, superintendent, has made a trip through Nevada, inspecting methods of milling, to obtain ideas as to the plant to be erected.

High Up—Professor Kerr, of Duluth, has finished a week's inspection of this group of claims, owned by E. W. Merritt, of Duluth. Recently a good body of milling ore was discovered in the property. Eastern men had the examination made.

Nevada

Comstock Lode

Union Consolidated—The west crosscut on the 2500-ft. level has penetrated a fractured territory having the strike and dip of the east vein system, being full of quartz stringers. The west crosscut has been connected with the east crosscut from the westerly workings, and an active campaign of prospecting will be prosecuted on this level. Exploration will also be conducted on the 2200-ft. level, where a north drift, carried through the Mexican to the Union line in the vein, has never been driven into the latter territory.

Mexican—A shipment of five bars of bullion was made last week as a partial cleanup. The bullion shipments for the month will total between $38,000 and $40,000.

Consolidated Virginia—A mill run has been started at the Kinkead mill, of ore accumulated during the driving of the 3-compartment raise in the vein from the 2400-ft. level.

Ophir—Improvement in the formation is noticed in the southwest drift on the 2500-ft. level, more quartz in place coming in as the drift is advanced. The work is now about 80 ft. north of a point under the first oreshoot opened on the level above.

Crown Point—Ore shipments to the Yellow Jacket mill last week totaled 472 tons.

Imperial—Work has been started cutting out for a station at the 200-ft. level, from which the vein will be prospected.

Esmeralda County

Goldfield Consolidated—The estimated April production was 28,317 tons, yielding $580,000 gross, and net, $385,000, with $195,000 operating expenses.

Pittsburg-Silver Peak—The company is doing its usual development of from 1200 to 1500 ft. per month and is milling from 15,000 to 16,000 tons of ore per month. The mill equipment, consisting of 120 stamps, followed by amalgamation with leaching of sands and filter-pressing of slimes in Merrill presses, is being increased by the addition of one 5x18-ft. tube mill for regrinding the coarser sands, four additional plates, 4½x16 ft., for amalgamation after tube-milling and by enlarging the 64 frame slime presses to 86 presses.

Humboldt County

Nevada-United—Work will probably be resumed on the company's claims. Geological examinations have been made recently in an attempt to define the position of orebodies from development work.

Lyon County

New Yerington—President C. N. Strevel of this company which took over the Yerington Copper Co., stated recently that the drift on the 250 level has opened some high-grade ore, carrying gold and silver, and also a body of lower-grade ore. The first car of the high-grade ore has been shipped to the smeltery and a second car will be ready soon.

Nye County

Shipments in tons from Tonopah mines to date and for the week ended Apr. 25, are as follows:

Mines	Week	Year to Date
Tonopah Mining	3,150	55,669
Tonopah-Belmont	1,800	36,076
Montana-Tonopah	1,033	17,057
Tonopah Extension	1,008	16,010
West End	750	11,889
Midway	.....	180
MacNamara	455	5,392
North Star	40	80
Totals	8,236	142,353
Estimated value	$205,900	.....

Keane Wonder—The new cable is being wagon-hauled over 26 miles of desert and mountain roads from Rhyolite, Nev., to the mine. The cable is over two miles long and weighs 15,000 lo. It is to be operated on the surface between the mine and the mill. There are distances between towers of about 1000 ft. where the elevation of the cable is about 1200 ft. from the surface.

White Pine County

Campbell—Frank O'Kelly, manager for this estate, was a recent visitor in Goodsprings, and announced that work will be done on the properties this summer. The property here comprises about 26 patented claims, scattered throughout the district. No work has been done on the claims for the last five years, owing to a clause in the will of the late A. G. Campbell, which held the property for sale at a fixed amount. The May Kirby, which has a considerable tonnage of ore blocked out, will be worked by the estate, and leases will be granted on the remainder of the property.

Hoosier—H. J. Jarman has this mine under lease and has shipped several cars of lead and zinc ore during the last month. He contemplates the erection of a small concentrating plant to treat the mixed lead and zinc ore blocked out in the mine.

Giroux—Shipments started on May 1, at the rate of about 200 tons per day, under the contract with the Steptoe concentrator. The latter has provided storage for 2000 tons and a run will be made when this amount has accumulated. Shipments will be brought up gradually to contract requirements. The company is reported to have contracted with the Nevada Consolidated, for the latter to mine Butte & Ely ground owned by the former, and adjoining the Liberty pit.

New Mexico

Grant County

Silver Cell—An option on this group of mines near Pinos Altos has been secured by George L. Rule, representing Oklahoma men, from Dimmick Brothers, and operations will start soon. The mines were discovered about 26 years ago and have shipped considerable bullion. The shaft is over 300 ft. deep and there are a number of tunnels and drifts. From time to time the mines have been rather fully equipped with machinery, including a smeltery.

New York

Benson Mines Co.—The company is arranging to electrify its iron mines at Benson Mines, and will install a complete new equipment of General Electric Co. apparatus to supply power both for crushing and grinding. The new machinery comprises two 437-kv.-a., water-wheel-type generators, two 12-kw. generators, six 300-kv.-a. transformers, one 450-kv.-a. generator, one 12-kw. generator and 16 motors ranging from 5 to 200 horsepower.

Oklahoma

Bartlesville Zinc Co.—This company has completed plans for an extension of the electrical equipment in its existing plant at Collinsville, and will install one 100-kw. turbo-generator set, one 25-kw. motor generator set, two 50-hp. motors, one 25-hp. motor, one 75-hp. motor and a switchboard. The apparatus will be furnished by the General Electric Co.

Oregon

Powder River Gold Dredging Co.—The company, which has acquired considerable dredging ground along the Powder River, south of Sumpter, has commenced work on the construction of a dredge.

Rainbow—This property, in the Mormon Basin district, purchased about a year ago by the United States Mining Co., one of the subsidiaries of the U. S. Smelting, Refining & Mining Co., has been under development for the last year. It has been decided to install a mill during the coming summer. Electrical power will probably be taken from the Eastern Oregon Light & Power Company.

Tennessee

Tennessee Copper Co.—The company will install a complete low-pressure turbine equipment for the Copperhill plant. The exhaust steam from the non-condensing power engines, steam pumps and other auxiliaries will be piped into a steam regenerator, so as to deliver a steady flow of exhaust steam to a Rateau-Smoot mixed-flow, turbo-blower, which will deliver 40,000 cu.ft. of free air per minute at a pressure of 3 lb. The turbine will be equipped with a surface condenser. The plant, which will be furnished by the Rateau Steam Regenerator Co., will be in operation in the autumn.

Utah

Beaver County

Noonday—A vein of iron ore, carrying gold, silver and lead, in small amounts, has been opened on the 110-ft. level. Shaft sinking is in progress and will be continued to the 300-ft. level.

South Utah—The March production amounted to 298,999 lb. copper, the ore treated running 1¼% copper. Concentrates averaged 8.99% and the ratio of concentration was 14: 1. The mill recovery was 55%.

Galena King—A car of lead-silver ore was shipped recently, making the second car for April. Bad roads have kept down shipments.

Juab County

Tintic shipments for the week ended Apr. 25 amounted to 181 cars.

Opohongo—The winze from the 700-ft. level is down 40 ft., and two cars of the ore have been marketed. On the 1000 level, drifting is being done for a fissure, opened through the Black Jack at 1400 ft., and found to carry ore.

Mammoth—The copper ore on the 700-ft. level has been stoped to the level above.

Tintic Standard—Drifting northeast from the shaft is in progress on the 1000-ft. level. Iron sulphides and thin stringers of lead show in the face.

Tintic Mining & Development—The new electric hoist is in commission, and the shaft is sinking 5 ft. per day. Power is furnished by the Telluride Power Co.

Victoria—During 1911, 2843 tons of ore were mined, and net returns were $42,464. The balance on hand, Mar. 31, 1912 was $16,349. In September, 1910, the property of the Snowflake Mining Co. was acquired for $40,000. To meet this and other expenses, it was necessary to give notes for $60,000, which is the amount of present indebtedness.

East Tintic Development—One car of ore has been shipped recently and another will soon be ready. There is a good showing on the 130-ft. level.

Carisa—The shaft, damaged some time ago by caving, has been retimbered to the 700 level. Leasers are working on the upper levels.

Eagle & Blue Bell—Ore has been opened on the 1200- and 1300-ft. levels. On the latter both faces are in ore. Additional cables are on hand, and sinking will be resumed.

Salt Lake County

Bingham Mines—The ore in the Dalton & Lark is coming from the Brooklyn orebody, which has been productive for so many years. This ore has been opened to a depth of 2000 ft. on its dip, and is still going down.

Ohio Copper—A record tonnage of 2700 tons for one day is reported, the daily average for the last week having been over 2000 tons.

Utah Metal—Both faces of the tunnel are in hard quartzite. The Bingham side is in nearly 1100 ft., and the Tooele side, 7400 feet.

Montana-Bingham—The tunnel is in 750 ft., the face being 350 to 400 ft. below surface. The face has been in low-grade ore for some distance, and possibly the work is near the Quinn fissure.

Michigan-Utah—Shipping ore has been opened in the Utah Mines Coalition property, in places ranging from the 750- to the 1000-ft. level.

Alta Consolidated—Carbonate ore is reported to have been opened 125 ft. above the main tunnel level, where the upper contact has been reached.

Bingham Copper—This company was petitioned into bankruptcy, Mar. 26. Stockholders have been requested to deposit their stock with the Utah Security & Trust Co., with a check for 5c. per share, which assessment will be sufficient to satisfy all claims against the company. Stockholders will be allowed until June 1 to make payment.

Summit County

Park City shipments for the week ended Apr. 27, amounted to 3,147,140 pounds.

Ontario—Mill tests have been completed, and the work of remodeling the mill at a cost of about $80,000 will begin immediately. The mill will treat the low-grade ore developed during recent years, and the ore mined by leasers.

Thompson-Quincy—An incline shaft has been started about 30 ft. from the top of the raise, being driven from the 1600-ft. level. The raise is up about 350 feet.

Wyoming

Fremont County

Beck Mining Co.—This company is operating the Duncan mine, and has worked continuously through the winter. Mr. Beck, president, is in Denver closing contracts for the equipment of a cyanide addition to the mill, which will operate on the continuous-decantation system. By regrinding the sands, it is expected to increase the present capacity of 35 tons to 50 tons per day.

Carissa—It is reported that this company, at South Pass, will remodel its mill this summer, preparatory to resumption of mine operations.

Mary Ellen—This mine, adjoining the Duncan mine on the east, is being worked on a small scale, and is under option to Denver men, who may install a mill.

X-L Placer Mining Co.—The company completed its pipe and ditch line last summer, and is preparing to hydraulic the ground.

Canada

British Columbia

In consequence of the threatened landslide at Turtle Mountain, the inhabitants of the mining town of Frank, which is believed to be in danger of destruction, are preparing to remove to another townsite. The Canadian Coal Consolidated, Ltd., which operates the mines is arranging for the removal of 33 buildings to the new townsite.

Mining in the Lardeau district is practically at a standstill. Aside from assessment work, practically nothing is being done. Some properties contain surface indications which are stated to warrant development, but it is difficult to interest capital. Inadequate transportation facilities are a great drawback.

Silver Cup—As far as known orebodies are concerned, this mine is nearly worked out. At present a small force is engaged in cleaning up the mine, which will be abandoned unless further oreshoots are discovered.

Standard Silver-Lead Mining Co.—This company has recently been shipping about 750 tons per month of silver-lead ore and concentrates.

Van Roi—During the first four months of this year, the company shipped a total of concentrates as follows: Lead, 1140 tons, assaying approximately 200 oz. silver, 61% lead and 12% zinc per ton; zinc, 840 tons assaying about 75 oz. silver, 3½% lead and 46% zinc, per ton. About 5000 tons of ore per month are being milled.

Granby—The directors on May 7 considered several plans for financing the Hidden Creek smeltery, including the issuance of 10-year bonds, loans from banks and application of earnings from the old mine. No decision was reached.

Ontario-Cobalt

Shipments of ore and concentrates, in tons, from Cobalt for the week ended May 3, and for the year to date, are:

La Rose	72.63	1,147.32
Coniagas	120.30	666.65
O'Brien	31.43	231.21
Right of Way	38.30	148.60
Chambers-Ferland	32.00	161.60
McKinley-Darragh	35.01	955.74
Nipissing	76.06	629.06
Hudson Bay	.....	249.88
Buffalo	31.64	382.37
Crown Reserve	.....	170.48
Cobalt Townsite	50.24	406.72
City of Cobalt	.....	145.84
Trethewey	27.13	174.19
Colonial	.....	20.00
Kerr Lake	61.31	292.79
Cobalt Lake	40.25	176.26
Drummond	.....	300.32
Temiskaming	60.27	320.64
Beaver	30.35	132.34
Wettlaufer	.....	111.21
Provincial	.....	22.22
Casey Cobalt	.....	24.50
Totals	706.92	6,869.94

Bullion Shipments in Ounces

Mine	Week	Year to Date
Nipissing	102,013.02	1,292,361.54
Miscellaneous	2,929.00	.....

Temiskaming—A number of the men have stopped work on account of two union miners having been discharged.

Ophir—The directorate has been reorganized and work has been started on the sinking of a 200-ft. shaft on a large vein on the south end of the property. Mr. Gordon, consulting engineer of the Cobalt Lake, is in charge.

Cashman—This Elk Lake claim, lying east of the Moose Horn, has been sold for $35,000 to Ottawa men.

Buffalo—This company has acquired an interest in a property in Gowganda.

Ontario-Porcupine

North Dome—Good ore has been opened in the drifts on the 50-ft. level. This discovery may have an effect on the vote of the shareholders, which will decide whether the property is to be sold.

Dome Lake—This company has placed an order for a 10-stamp mill.

Rea—The stockholders will meet soon to discuss the financing of the property. Some still believe it has merit, but realize that the necessary development would call for a large expenditure. Some of the stores on hand at the mine are being sold.

Lucky Cross—The east crosscut on the 100-ft. level of this Swastika mine has intercepted a 12-ft. vein carrying good ore.

McIntyre—This company has shipped another bar of bullion weighing 144 ounces.

Pearl Lake—Negotiations are under way to relieve the financial difficulties of this company, and to enable it to resume work.

Little Pet—The 5-stamp mill is expected to be completed about May 15. The ore occurs in quartz stringers in the porphyry. The intervening porphyry carries from $2 to $3 per ton in gold.

Dome—This company, on May 5, will make another shipment of bullion.

McEaneny—On this property, belonging to the Crown Reserve, ore is being blocked out on the 100- and 200-ft. levels.

Quebec

East Canada Smelting—Pending construction of the Bleichert aërial tramway to Weedon, this company is stockpiling from 100 to 125 tons per day, taken out in development. All material for the 19,480-ft. tramway, which comprises 48 towers and two anchor and tension stations, is now on the ground. When the tramway is completed in June, production will be resumed at the rate of about 200 tons per day. Leland D. Adams is superintendent.

Mexico

Chihuahua

Veta Colorado—Work at both mine and mill has been completely suspended, due to inability to obtain supplies.

Presena—The new compressor has been installed, but work on the aërial tramway has been delayed by nonarrival of material. Work is being pushed as rapidly as possible under the direction of T. G. Hawkins.

Mina Maria—Robbers have again looted the property, this time taking all the provisions, clothes, etc., in the store. Operations at the mine will probably be suspended before long.

Sonora

Elsie—Four men were killed by a cave-in recently. Two others who were buried, were rescued alive.

Greene-Cananea—Revolutionary troubles are said not to be interfering with mine operations.

South America

Chile

Braden—Electric haulage is in operation at Nos. 3 and 4 Fortuna tunnels, and stopes are being opened. Miners receive the equivalent of about 75c. per day. All the Fortuna tunnels except No. 2 are stopped in low-grade material. At the Teniente mine the tunnels have been advanced in good ore. The first half of the third unit of the mill is expected to be ready for operation by May 15. At the smeltery, further adjustments and installations are expected to reduce costs considerably. The leaching plant should be completed by the middle of July.

Asia

Chosen

Oriental—Cable advices state that the April cleanup was $139,000. During March, the bullion produced was worth $126,994, and 24,295 tons of ore were crushed.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

Coal Trade Review

New York, May 8—The coal trade in the West is gradually shaking down into shape. Current trade is improving as the strike accumulations are being worked off by consumers, and the opening up of the Lake trade is stimulating production.

The seaboard bituminous trade is quiet, but recent developments in the anthracite region have unsettled matters, and there may be a better demand.

Rather contrary to expectation, the anthracite conference rejected the compromise agreement made by the subcommittee. The plan has been referred back to a special convention of the miners, and it will take a week or more to determine finally whether it will be accepted by them. The continued postponement has unsettled the trade.

The Pittsburg district shippers are not satisfied with the new rates on Lake coal and want a further adjustment, claiming that the West Virginia operators are still getting an undue discrimination in their favor.

Belgian Coal Trade—Imports of fuel into Belgium, three months ended Mar. 31, were 1,054,231 metric tons of coal, 282,774 tons of briquettes and 246,675 tons coke. Exports were 1,970,145 tons coal, 98,336 tons briquettes and 210,526 tons coke.

Iron Trade Review

New York, May 8—The iron and steel markets show much the same conditions as for several weeks past. The month so far has not shown much, if any, decrease in activity from April. Mills are generally busy and specifications are coming in freely. New railroad orders coming in freely also.

The tendency of prices continues to be to advance, and this week galvanized sheets are quotable $1 a ton higher as a minimum, while tinplate is quotable $2 a ton higher, a price of $3.40 having been named to jobbers for third quarter. The $3.40 price would probably be shaded by one or two mills in the case of large lots to canners, but the prospect is that if pig tin continues strong there will be a further advance in tinplate to $3.50 per box.

With contracts and specifications now on books the steel mills are assured of full operation at the present gait for at least three months. Presumably, however, the pressure will last for a longer time. There is actual new buying at the advanced prices of 1.20c. for bars and 1.25c. for plates and shapes, though there is not much as nearly all buyers are under contract at lower figures.

Railroad buying is to the front again, purchases of cars and rails having been particularly heavy in the past ten days. It is believed that a great deal more business has been practically arranged and will be announced from week to week.

Orders for cars placed thus far this year make a total of over 60,000, of which more than 20,000 have been placed within the past fortnight. The car shops have been operating in the past few months at between 50 and 60 per cent. of full capacity, and already have enough business on books to insure operations at this rate for the balance of the year.

Pig iron has sold well, both basic and foundry being in demand. Prices are again a shade firmer on new orders, and Southern furnaces are holding well up to their late quotations.

A reversal of a past trade current is seen in the export this week of 489,425 lb. tinplates from Baltimore to Liverpool. This may be a result of the stoppage of Welsh tinplate works by the coal strike, but it is an unprecedented shipment.

The Steel Corporation Suits—The taking of testimony in the Government suits against the Steel Corporation began before a special master in New York, May 6. A large number of witnesses have been called. The opening evidence related chiefly to the condition of the iron and steel trades at the time the Steel Corporation was organized, and it brought out nothing new. It looks very much as if the evidence would follow the lines of that given before the Stanley committee.

Baltimore

May 6—Exports for the week included 1,872,100 lb. steel billets and 489,425 lb. tinplates to Liverpool. Imports included 5994 tons pyrites from Huelva, Spain; 17,850 tons iron ore from Cuba.

Birmingham

May 6—Inquiries for pig iron are being received by Southern manufacturers in such tones as to indicate there will be a need for considerable tonnage during the last half of the year. The quotations are firm around $11@11.25 per ton, No. 2 foundry. Preparations are being made for the blowing in of two blast furnaces and the make is to be increased. The reduction of the accumulated stacks of iron continues steadily, and the general conditions are improving. There has been a little export iron moved again.

Cast-iron pipe interests in the Southern territory are melting iron in greater quantities than ever before. There is no end to the demand for pipe. The pipe interests have made arrangements for the greater portion of their probable needs during 1912 in the last few weeks, having purchased a large tonnage of iron. The improvements at the Dimmick plant, of the United States Cast Iron Pipe & Foundry Co., are being rushed, and a portion of this plant is going.

Some improvement is noted in the machine-shop and foundry trade in Southern territory. The charcoal-iron trade holds its own with quotations firm at $22@22.50 per ton. The scrap-iron market is strengthening up.

In steel a few orders are being received for rails, while fabricated steel, produced at the rolling mills, at Bessemer, is in strong demand.

Chicago

May 7—The iron market is firm, with pig iron especially strong in view of the continuing large demands of melters. In each of the last two weeks 30,000 to 40,000 tons has been sold and the furnacemen are asking about 50c. premium on many requirements for the last half generally, over the current quotations of $14.50@14.75 for Northern at the furnace and $11@11.25 Birmingham, or $15.35@15.60 Chicago, on No. 2 foundry iron, for second- and third-quarter delivery. The furnaces are well sold up and the melters are becoming more anxious about the future. Sales have ranged from 200 tons up into the thousands, the tendency being to buy more heavily than for many months past. Northern charcoal iron is not so strong but in good demand at $15.50@16.50. Sales now are chiefly of Northern foundry, the Southern sellers being inclined to hold off.

In the material market there is a gradually increasing demand for the leading lines. Structural steel is in demand for bridge and building work over a wide range of territory, at 1.43c. Chicago for material under 15 in. Railroad supplies are in increasing demand, light rails and track fastenings having a very good market and inquiries for standard rails being numerous. Bars are in lighter but still fair demand, soft-steel bars be-

ing sold at 1.38c. and bar iron at 1.20c. Chicago. Plates are rather quiet at 1.43c. and sheets are in like condition at 2.30c. for No. 28 gage, Chicago. The wire goods market is slowly increasing. General business conditions continue to improve and the outlook is good in many lines.

Cleveland

May 6—Iron-ore business is slow, season sales having about closed. The Pittsburg Steamship Co. has made charters for about 7,000,000 tons outside of its own boats.

Pig Iron—Sales have been good and there are many inquiries, mostly for small lots. Quotations, Cleveland delivery, are $15.15 for bessemer, $13@13.50 for No. 2 foundry, $12.50@12.75 for forge and $15.50@16 for Lake Superior charcoal.

Finished Material—The recent advances in price are being well maintained, but not much new business has been coming in, owing to the heavy contracts closed in April. Specifications, however, are large.

Philadelphia

May 8—Large sales of basic, foundry, forge and malleable pig iron have been made during the past few days. The well sold condition of many furnaces and the decreasing stocks have led makers to view with indifference some urgent inquiries for delivery during the third quarter of the year. The higher range of prices is being easily maintained. Large transactions in basic have been closed. The high price of coke continues to be a disturbing factor. Some pig-iron makers refuse to quote prices offhand for late delivery, but promise inquirers to do the square thing as soon as they can size up the situation. Malleable iron has done better than for several weeks. Additional sales of low-grade have been made at prices slightly higher than since Jan. 1 by about 25c. a ton. Basic is particularly sought after, but the actual sales do not correspond to the inquiry. Quotations may be fairly given at $15.50 for No. 2 X foundry, with a minimum of $15 for Southern No. 2. Gray forge, both Northern and Southern, hangs around $14.50 though more money is demanded for two or three Northern grades.

Billets—Billets have advanced supposedly $1 a ton, and business is being done on this basis, as all former quotations have been withdrawn. Both bessemer and openhearth are firm and makers have the advantage, as buyers have now very little material on which to go and come.

Bars—Bars have moved up fractionally and are safely quoted at a minimum of 1.30c., though much business which is coming in at a retail way is closed at 1.35@1.40c. The outlook for common iron is better than it has been for months.

Sheets—Sheet-iron orders are quite numerous, but for small lots in a piecing-out way.

Pipes and Tubes—Pipes are active for merchant purposes, and tube work is abundant. Discounts are unchanged.

Plates—The advance in steel plates has stimulated inquiry and at the same time seems to have checked the placing of business. As matters stand, the mills have a decided advantage and higher quotations are probable. For prompt deliveries an advance on small lots is already as good as made.

Structural Material—Increasing inquiries are crowding in the market. There is increased demand for small lots.

Scrap—Good grades of scrap are being picked up and all kinds are moving with freedom. Preference is shown for heavy steel melting scrap at an advance of 50c. per ton.

Pittsburg

May 7—Mills are placed under increased pressure for deliveries of bars, plates and shapes, buyers being very insistent upon quick delivery. The evidence is that the material is actually being consumed. The pressure for deliveries of sheets and tinplates has increased, though it is not as great as in the other lines. Pipe and wire products are relatively slack, the mills having no difficulty in making desired deliveries, and indeed not being under the necessity of operating at full capacity.

Pig Iron—There has been considerable quiet buying of pig iron, particularly of foundry iron in the Central West and of basic iron in the East. It is understood that a large tonnage of Midland iron has been sold to eastern furnaces. Forge has definitely advanced, two sales made last week aggregating nearly 3000 tons bringing $13, Valley, or within 25 cents of the price of No. 2 foundry. This is likely to advance; indeed there seems to be little offered at $13.25 and it is reported that $13.50 has already been paid. We quote: Bessemer, $14.15@14.25; basic, $13; forge, $13; No. 2 foundry, $13.25@13.50; malleable, $13, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburg. The bessemer average for April as compiled by a trade interest from actual sales, is announced at $14.25, Valley, against $14.0536 for March, and the basic average at $12.981, as compared with $12.76 for March.

Ferromanganese—The ferromanganese market for forward delivery has been quiet since the $2.50 advance of Apr. 29, but the price is well held at $46, Baltimore. Odd lots for prompt shipment are bringing premiums, prices running up occasionally to $50, Baltimore.

Steel—There is not a great deal of inquiry for billets or sheet bars, but the large mills are practically out of the market and turn down such inquiries as appear. There is a little material in the hands of brokers, and the small independent openhearth mills as a rule have a little steel to sell. Large consumers are well covered by contracts, but are not getting satisfactory deliveries and would like to buy additional tonnage on the outside if they could get the material without paying too large a premium. The Steel Corporation has bought a small lot of openhearth sheet bars from the Republic Iron & Steel Co., quite an unusual transaction, and due to its operating its Ohio mill at Youngstown partly on openhearth rails. We quote the market higher again, by $1 a ton, at $21.50 for billets and $22 for sheet bars, f.o.b. maker's mill, Pittsburg. Rods are nominally $25, Pittsburg.

Sheets—Some of the independent mills are now adhering to the recently advanced prices of the leading interest as a minimum, these prices being 1.95c. on black and 3.00c. on galvanized. Occasionally 1.90c. is quoted on desirable orders by some of the independents, but the 2.90c. price on galvanized, quoted as the minimum in the past two or three weeks, has disappeared, 2.95c. seeming to be the minimum. Specifications are good. We quote: Black sheets, 1.90@1.95c.; galvanized, 2.95@3.00c.; blue annealed, 1.40c.; painted corrugated, $1.35 per square; galvanized, $2.55 per square. The American Sheet & Tin Plate Co.'s charges, over prices for flat sheets, are 5c. per 100 lb. for corrugating, and 15c. per 100 lb. additional for painted, gages 25 to 28 inclusive.

St. Louis

May 6—The pig-iron market still continues quite brisk and strong. Buyers who did not place the last of their first-half requirements a month ago are coming in now and are trying to buy at $11@11.25, though $11.50 is being asked. Inquiries are coming in for third- and fourth-quarter delivery. No. 2 Southern foundry is readily bringing $10.50@11 Birmingham, or $14.25@14.75 St. Louis.

Coke is moving fairly well at $5@5.10 per ton, St. Louis.

Iron Ore Trade

Imports and exports of iron and manganese ore in the United States, three months ended Mar. 31, long tons:

	1911	1912		Changes
Iron ore, imp.....	332,205	441,280	I.	109,075
Iron ore, exp.....	7,326	24,224	I.	16,898
Manganese, imp.....	51,340	77,638	I.	26,298

The iron-ore imports this year included 48,695 tons from Spain, 71,517 from Sweden and 314,180 from Cuba.

The first cargo of ore to reach a Lake Erie port this season was one of 9000 tons from Escanaba, which reached To-

ledo, Apr. 25. The following day a cargo of 7951 tons, also from Escanaba, reached Ashtabula. No boats have come through from Duluth yet, as the ice at the Sault is slow in clearing out, but the first boats from Lake Superior are expected this week.

United States Foreign Trade

Exports and imports of iron and steel and of machinery in the United States for three months ended Mar. 31, are valued as below by the Bureau of Statistics of the Department of Commerce and Labor:

	1911	1912	Changes
Exports	$58,890,174	$64,728,283	I. $5 838,109
Imports	7,972,333	6,474,678	D. 1,497,655
Excess, exp.	$50,917,841	$58,253,605	I. $7,335,764

Increase in exports, 9.4%; decrease in imports, 18.8%. The leading articles of iron and steel were, in long tons:

	Exports		Imports	
	1911	1912	1911	1912
Pig iron	40,926	47,139	41,932	28,792
Scrap	19,373	24,328	4,599	2,313
Billets, blooms, etc.	68,182	51,984	13,191	4,407
Bars	36,401	41,442	7,840	4,707
Rails	105,527	81,039	. ...	942
Sheets and plates	74,768	111,033	661	525
Structural steel	46,748	55,043	.....	547
Wire-rods	3,886	13,920	4,465	3,857
Wire	46,811	43,719	.....	.....
Nails and spikes	17,470	22,658	.....	.....
Tinplates	9,601	15,329	7,707	617
Pipe and fittings	32,199	48,930	.....	.....

Imports of wire are not reported in quantities; values were $331,711 in 1911 and $152,726 in 1912. Exports of mining machinery in 1912 were valued at $1,541,180, a decrease of $184,594 from last year.

METAL MARKETS

New York, May 8—The metal markets generally have been rather quiet, with no material changes from last week.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold			
Mar. 1912	$ 7,453,589	$ 4,335,678	Exp. $3,117,911
" 1911	505,615	4,119,063	Imp. 3,613,448
Year 1912	19,958,088	12,414,195	Exp. 7,543,893
" 1911	1,854,014	19,465,737	Imp. 17,611,723
Silver			
Mar. 1912	5,806,307	3,711,734	Exp. 2,094,573
" 1911	5,896,795	3,197,409	Exp. 2,699,386
Year 1912	16,955,988	11,850,220	Exp. 5,105,768
" 1911	16,001,842	10,646,781	Exp. 5,355,061

Exports from the port of New York, week ended May 4: Gold, $107,125, chiefly to Panama; silver, $734,233, principally to London. Imports: Gold, $366,099; silver, $264,055, largely from Mexico and South America.

Gold—The price of gold on the open market in London remained at the usual level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. There is still a good demand for India and Egypt; outside of that most of the gold arriving went to the Bank of England.

Platinum—The market is reported steady, but rather inactive. The quotations are unchanged. Dealers ask $45.50 per oz. for refined platinum and $48 per oz. for hard metal.

Our Russian correspondent writes, under date of Apr. 26, that the market is without change. The offer of small lots by the starateli is beginning to increase, as operations are started at the placers which were closed in the winter. The stocks held by speculators are rather large, but they are in strong hands and not likely to be forced on the market. Quotations for crude metal, 83% platinum, are 9.90 rubles per zolotnik, at Ekaterinburg, and 38,000 rubles per pood at St. Petersburg—equal to $37.22 and $37.24 per oz., respectively.

Silver—Owing to large orders in London by the Indian Bazaars, the price of silver for the last week has been well maintained.

SILVER AND STERLING EXCHANGE

May	2	3	4	6	7	8
New York	61	60⅞	60⅝	60⅛	60¼	60⅛
London	28⅛	28 1/16	27 15/16	27 11/16	27¾	27⅞
Sterling Ex.	4.8680	4.8690	4.8690	4.8680	4.8680	4.8675

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to Apr. 25, reported by Messrs. Pixley & Abell:

	1911	1912	Changes
India	£3,123,700	£2,245,800	D. £877,900
China	802,800	630,000	D. 172,800
Total	£3,926,300	£2,875,800	D. £1,050,700

India Council bills in London averaged 16.05d. per rupee for the week.

Copper, Tin, Lead and Zinc

NEW YORK

May	Copper: Lake, Cts. per lb.	Copper: Electrolytic, Cts. per lb.	Tin: Cts. per lb.	Lead: New York, Cts. per lb.	Lead: St. Louis, Cts. per lb.	Zinc: New York, Cts. per lb.	Zinc: St. Louis, Cts. per lb.
2	15⅞ @16	15.65 @15.75	45¾	4.15 @4.20	4.02½ @4.05	6.55 @6.75	6.40 @6.60
3	15⅞ @16	15.65 @15.75	45⅝	4.15 @4.20	4.02½ @4.05	6.55 @6.75	6.40 @6.60
4	15⅞ @16	15.65 @15.70	45⅝	4.15 @4.20	4.02½ @4.05	6.55 @6.65	6.40 @6.50
6	15¾ @16	15.60 @15.70	45½	4.15 @4.20	4.02½ @4.05	6.55 @6.65	6.40 @6.50
7	15¾ @16	15.55 @15.65	45⅞	4.15 @4.20	4.02½ @4.05	6.50 @6.65	6.35 @6.50
8	15¾ @16	15.55 @15.65	45⅞	4.15 @4.20	4.02½ @4.05	6.50 @6.60	6.35 @6.45

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

May	Copper: Spot	Copper: 3 Mos	Copper: Best Sel'td	Tin: Spot	Tin: 3 Mos	Lead, Spanish	Zinc, Ordinaries
2	69⅜	70⅜	74½	210½	206½	16½	25¾
3	69⅝	70⅜	74½	208½	204¼	16⅛	26
4	.....	.....	.....	.....	.....	.....	.....
6	69 3/16	70¼	74½	208	204	16½	25½
7	69	69 11/16	74	208⅜	204½	16⅛	25⅝
8	69⅛	69¾	74	209¾	205¼	16½	25⅝

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

Copper—The market during the week of May 2-8 has again been characterized by absence of demand, the volume of business having been smaller than during the previous week. Domestic manufacturers seem to be overbought and the European market is temporarily so much out of tune with ours that we cannot sell copper to Europe except under peculiar conditions. There appears to be a considerable stock of cathodes in England for sale at about 5s. premium over standard copper, or at about 15.30c., which is 0.25c. less than the price here. One of the leading agencies has maintained its asked price at 16⅛c.; another at 16c.; but others have offered at 15⅞c. and in the latter part of the week have openly quoted 15¾c., all prices delivered, usual terms. Sales have been reported at 15⅞c. down to 15¾c., delivered, usual terms. The market for Lake copper has been but nominal, the business in this kind that has been reported being insignificant. At the close, Lake copper is quoted at 15¾@16c., and electrolytic copper in cakes, wirebars and ingots at 15.55@15.65c. Casting copper is quoted at 15¼@15⅜c. as an average for the week.

The London standard market has been quiet and weakish. On May 2, it was £59 7s. 6d. for spot and £70 2s. 6d. for three months. On May 3 it advanced 5s., but by May 7 had declined to £69 for spot and £69 13s. 9d. for three months, and closed on May 8 at £69 3s. 9d. for spot, and £69 15s. for three months.

Copper sheets are 21@22c. base for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 17@17⅛c. base, carload lots at mill.

Copper exports from New York for the week were 4246 long tons. Our special correspondent gives the exports from Baltimore at 1591 tons.

Visible stocks of copper in Europe on May 1 were: Great Britain, 34,690;

France, 6040; Rotterdam, 2750; Hamburg, 7370; afloat from Chile, 2050; afloat from Australia, 7000; total, 59,900 long tons, a decrease of 190 tons from the Apr. 15 report.

Brass Prices—The American Brass Co. announces the following prices, taking effect May 1: Sheets, high brass, 17c. net per lb.; low brass, 18⅝c. Wire, high brass, 16¾c.; low brass, 18⅝c. Rods, high brass, 16¼c.; low brass, 19⅜c. Tubing, brazed, 21½c.; open seam, 20⅜c.

Tin—The activity of last week abated considerably and gave way to a rather dull market. Consumers in this country seem to be afraid of present high prices and are covering their immediate wants only. There was some business done among dealers, and it is reported that lots of future tin have been resold from this market to London. The excellent consumption continues, and looking at the statistical position of the metal only, the present and even higher prices are fully justified. The close is firm at £209 15s. for spot, and £205 5s. for three months, and about 45⅞c. for May tin in this market.

Visible stocks of tin on May 1 were: London, 6288; Holland, 725; United States, excluding Pacific ports, 4880; total, 11,893 long tons, a decrease of 3800 tons from Apr. 1 report.

Lead—This has been the dullest of all the metals. The A. S. & R. Co. maintains its price at 4.20c., New York, but independent interests have sold at 4.15c. At St. Louis, sales of Southwestern Missouri lead have been made at 4.05c., and of Southeastern at 4.02½ cents.

The London market is unchanged at £16 10s. for Spanish, and 2s. 6d. higher for English lead.

Spelter—The market during the week of May 2-8 has been rather chaotic. Vexed by the operations of some of the smaller smelters, leading interests offered spelter freely and cut prices to effect business. In the aggregate several thousand tons were sold for deliveries ranging from May to August at prices varying considerably for the same deliveries. In our quotations we have generalized the market according to the preponderating business rather than giving the extremes. There seem to have been liberal supplies of metal available for all deliveries. Some of the leading consumers have not been in the market, claiming to be well covered for two months ahead and uninterested in later spelter at any terms that have yet been offered. The close is quoted at 6.35@6.45c., St. Louis, and 6.50@6.60c., New York.

In London the market is quiet and somewhat easier. Good ordinaries are quoted at £25 12s. 6d., and specials at £25 17s. 6d. per ton.

Zinc dust is quoted at 7⅛c. per lb., New York, in carload lots.

Base price of zinc-sheets is $8.65 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Other Metals

Aluminum—The announcement that the English, French, German, Swiss and American makers have agreed upon the basis for a new syndicate has sent prices up materially abroad. The quotation in London has advanced from £54 to £64 per long ton, and the German price from 108 to 132 marks per 100 kg.—the latest prices being equivalent to 13.91 and 14.25c. per lb. This would be about 21 and 21¼c., duty paid, New York. The American makers have generally met the price at which imported metal can be laid down in New York.

Business here has been quiet. We quote 21@22c. per lb. for No. 1 ingots, New York.

Imports of aluminum into the United States for the quarter ended March 31 were 6,204,754 lb.

The Aluminum Castings Co., of Cleveland, O., which already controls 11 plants, has taken an option on a foundry property at Milwaukee, Wis., and purposes establishing another plant there for the manufacture of aluminum into finished forms.

Antimony—Business has been on a moderate scale, and prices are unchanged. Cookson's is 8@8⅛c. per lb.; Hallett's and U. S. are 7¾; while 6⅞@7c. is quoted for Hungarian, Chinese and other outside brands.

Quicksilver—Business is steady and prices here are unchanged. New York quotations are $41.50@42 per flask of 75 lb., while 60@62c. per lb. is charged for retail lots. San Francisco, $41.50 for domestic orders and $39 for export. The London price is £8 5s. per flask, with £8 quoted from second hands.

Zinc and Lead Ore Markets

Platteville, Wis., May 4—The highest price paid this week for zinc ore was $54.50 per ton; the base price, 60% zinc, was $52@53. The base price paid for 80% lead ore was $53@54 per ton.

SHIPMENTS, WEEK ENDED MAY 4

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point	948,110	.....	.....
Cuba City	603,530	.....	.....
Galena	560,900	.....	.....
Benton	486,700	.....	511,000
Hazel Green	440,000	.....	.....
Platteville	432,200	.....	.....
Harker	326,480	.....	.....
Shullsburg	143,000	84,000	.....
Rewey	85,000	.....	.....
Dodgeville	66,000	.....	.....
Linden	65,270	.....	.....
Montfort	.....	80,000	.....
Total	4,157,190	164,000	511,000
Year to date	68,452,630	2,285,790	8,052,750

Shipped during week to separating plants, 2,442,440 lb. zinc ore.

Joplin, Mo., May 4—The high price for zinc sulphide ore is $59.50, the base, per ton of 60% zinc, $50@57.50 per ton. Zinc silicate sold on a base of $26@29 per ton of 40% zinc. The average price all grades of zinc, is $49.64. The high price of lead ore is $55, though a very large tonnage sold as low as $51 per ton. The average price, all grades of lead, is $52.74 per ton.

The year 1912 would have gone down in history as among the wettest in this mining region without the downpour of last Saturday night and Sunday. During 10 hours Saturday night 3.32 in. of water fell and Sunday night 0.20 in. The rain came on all portions of the district, flooding every stream and inundating many mines, overflowing high levees, washing out mill ponds and causing a large aggregate of damage. Even at the end of a week it is impossible to estimate with any degree of accuracy the extent of reduction in output. This week it will exceed 1000 tons and may reach very near that figure for another week or two.

SHIPMENTS, WEEK ENDED MAY 4

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	3,212,040	.....	946,640	$110,679
Joplin	2,025,410	.....	254,860	61,185
Galena	745,740	.....	157,880	24,160
Duenweg	637,540	127,660	31,270	19,287
Granby	155,690	711,230	35,660	15,940
Oronogo	715,510	.....	.....	15,477
Alba-Neck	528,080	.....	.....	14,786
Miami	444,520	.....	87,380	11,965
Jackson	375,110	.....	.....	9,375
Cave Springs	256,000	.....	.....	7,160
Aurora	173,840	121,190	.....	6,335
Spurgeon	71,460	253,300	.....	5,505
Carl Junction	123,380	.....	.....	3,455
Springfield	136,670	.....	.....	3,440
Lawton	122,340	.....	.....	3,180
Carthage	102,000	.....	.....	2,600
Wentworth	59,680	45,310	.....	2,155
Quapaw	52,010	.....	.....	1,195
Ash Grove	.....	.....	42,440	1,060
Totals	9,937,020	1,258,690	1,556,130	$318,993
18 weeks	179,752,460	11,277,950	30,017,950	$5,303,227
Blende val., the week,	$258,180;	18 weeks,		$4,315,288
Calamine, the week,	19,713;	18 weeks,		163,381
Lead value, the week,	41,046;	18 weeks,		824,658

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January	$41.85	$44.90	$40.55	$43.54	$55.68	$58.92
February	40.21	45.75	39.16	43.31	54.46	52.39
March	39.85	51.56	38.45	49.25	54.57	54.64
April	38.88	52.00	37.47	50.36	56.37	54.18
May	38.25	.....	36.79	.....	55.21	.....
June	40.50	.....	38.18	.....	56.49	.....
July	40.75	.....	38.36	.....	58.81	.....
August	42.50	.....	41.28	.....	60.74	.....
September	42.63	.....	41.29	.....	59.33	.....
October	42.38	.....	40.89	.....	54.72	.....
November	45.40	.....	43.25	.....	57.19	.....
December	44.13	.....	40.76	.....	62.03	.....
Year	$41.45	.....	$39.90	.....	$56.76	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, May 8—The general trade continues to improve slightly, but with no important changes.

Copper Sulphate—Business is fair. Quotations are unchanged at $5.25 per

100 lb. for carload lots and $5.50 per 100 lb. for smaller parcels.

Arsenic—Aggressive buying by the manufacturers of insecticides is about over for the season, and supplies seem to have caught up with the demand. Prices are easier, $3.50@3.75 per 100 lb. being paid for white arsenic.

Nitrate of Soda—Business is good and prices are a little firmer. Quotations are 2.45c. per lb. for spot and 2.40c. for futures.

Messrs. Mortimer & Co., New York, report the position of nitrate in the United States on May 1 as follows, in long tons:

	1911	1912	Changes
Stocks, Jan. 1	12,790	9,000	D. 3,790
Imports, 4 mos	198,312	121,200	D. 77,112
Supplies	211,102	130,200	D. 80,902
Deliveries, 4 mos	194,522	125,600	D. 68,922
Stocks, May 1	16,580	4,600	D. 11,980
Afloat for U. S.	80,000	100,000	I. 20,000

Quantities afloat include all cargoes due to arrive at United States ports by Aug. 15 next.

Imports and Exports—Imports and exports of chemicals and raw material in the United States, three months ended Mar. 31:

	Imports	Exports	Excess
Copper sulph. lb.		5,779,766 E.	5,779,766
Copper sul., '11		4,745,036 E.	4,745,036
Bleach, lb.	21,942,656		I. 21,942,656
Bleach, 1911	27,040,572	17,368 I.	27,023,204
Potash salts, lb.	189,818,817	265,208 I.	139,553,609
Potash salts, '11	255,703,617	934,331 I.	254,769,286
Soda salts, lb.	3,137,282	130,898 I.	3,006,384
Soda salts, 1911	11,170,684	170,506 I.	11,000,178
Acetate lime, lb.		15,378,365 E.	15,378,365
Acetate, 1911		18,590,384 E.	18,590,384
Nit. of soda, tons	105,565	2,162 I.	103,403
Nitrate, 1911	189,408	1,980 I.	187,428
Phosphates, tons		229,279 E.	229,279
Phosphates, '11		242,018 E.	242,018
Sulphur, tons	4,817	3,272 I.	1,545
Sulphur, 1911	6,478	453 I.	6,025
Pyrites, tons	195,286	I.	195,286
Pyrites, 1911	253,562	I.	253,562
Magnesite, lb.	39,859,695	532,150 I.	39,327,545
Magnesite, 1911	62,054,419	685,300 I.	61,369,119
Sul. ammonia, lb.	39,737,933	I.	39,737,933
Sul. am'nia, '11	84,773,245	I.	84,773,245
Arsenic, lb.	936,778	I.	936,778
Arsenic, 1911	1,137,495	I.	1,137,495

Exports include reëxports of foreign material. Estimating sulphur contents of pyrites the total quantity of sulphur imported this year was 82,931 tons.

Petroleum

The monthly statement of the *Oil City Derrick* shows new wells completed in April as follows: Pennsylvania and West Virginia, 380; Lima-Indiana, 42; Kentucky, 11; Illinois, 69; Kansas-Oklahoma, 557; Texas-Louisiana, 104; total, 1163. In all the divisions there were 1163 wells completed, 242 more than in March. The new production was 64,728 bbl., an increase from the March report of 19,826 bbl. There were 205 failures among the completed wells, and 103 gas wells, a total of 308, leaving 855 oil producers.

On the last day of March there were 451 rigs up and 1200 drilling wells, a total of 1651. This was a decrease of 52 rigs and an increase of 112 in wells drilling.

The total petroleum production of Russia in 1911 was 9,435,000 metric tons; a decrease from 1911 of 186,000 tons.

Mining Stocks

New York, May 8—On May 2 business on the Exchange was active on special lines, but rather irregular. Steel common recovered the small loss it had made the previous day, on the publication of the quarterly statement. On the Curb the copper stocks were strong and active, British Columbia and Giroux leading. Cobalts were strong and there were free dealings in other mining shares.

May 3 a heavy selling movement on the Exchange brought down quotations on all the prominent stocks. An attempt was made to turn the market later, but with little success. On the Curb, Greene-Cananea advanced but other coppers were heavy. The market for mining stocks generally was off fractionally.

May 4 the Exchange was rather quiet and heavy, dealing being confined to a few stocks. The Curb was dull, copper stocks being inclined to fractional recessions, while dealings in other mining stocks were light.

May 6 the Exchange was reactionary on large dealings, mainly of a professional order. Steel common was the most active stock, losing several points. Toward the close there was a slight upward turn. On the Curb almost all mining stocks were active, but on practically lower quotations, the coppers showing the most weakness.

May 7 the Exchange was heavy and prices weak. There was heavy selling of Steel common, and the copper stocks listed on the Exchange were also weaker. On the Curb trading was dull and mining stocks were in small demand, the coppers being again weak. May 8 conditions were much the same, with a little better demand for the outside mines on the Curb.

Boston, May 7—It has been a period of reaction in the mining share market, due to market reasons rather than to fundamental conditions. Hancock has been among the exceptions. The striking of what looks like the old Pewabic lode brought quite a bit of buying and caused a sharp advance of $4.12½ to $36.12½. Both Mayflower and Old Colony stocks have been active, but reacted moderately on profit taking. The drills at these properties are expected to encounter the Mayflower lode at any time now. No. 18 drill at Mayflower is 1350 ft. down.

Copper Range has broken an extreme of $9.25 to $55, since the annual report was issued a week ago. Granby has been a notably strong and active feature after a rather severe break. This is due to the fact that the director's are planning as to the best means to finance the

COPPER PRODUCTION REPORTS

Copper contents of blister copper, in pounds

Company	Feb.	March	April
Alaska shipments	2,662,243	4,987,916	.....
Anaconda	27,450,000	25,900,000	25,480,000
Arizona, Ltd.	3,020,000	3,150,000	3,400,000
Copper Queen	6,046,860	7,197,121	.....
Calumet & Ariz.	4,452,004	4,652,000	4,104,000
Detroit	2,068,370	2,246,238	.....
East Butte	1,440,000	.....	.....
Mammoth	1,722,954	1,939,310	.....
Mason Valley	1,100,000	.....	.....
Nevada Con.	4,888,790	6,380,000	.....
Old Dominion	2,039,000	2,432,000	2,167,000
Ray	2,140,000	.....	2,612,500
Shannon	1,300,000	1,388,000	1,544,000
South Utah	283,838	299,000	.....
United Verde*	2,250,000	2,250,000	.....
Utah Copper Co.	8,612,739	8,160,000	.....
Lake Superior*	19,000,000	19,750,000	.....
Non-rep. mines*	8,000,000	8,400,000	.....
Total production	98,476,798	.....	.....
Imports, bars, etc.	18,976,513	23,519,215	.....
Total blister	117,453,311	.....	.....
Imp. in ore & matte	10,432,438	8,736,874	.....
Total	127,885,749	.....	.....
Miami	2,475,996	2,755,000	.....
Brit. Col. Cos.:			
British Col. Copper	860,003	.....	.....
Granby	1,773,496	1,882,073	.....
Mexican Cos.:			
Boleo	2,204,720	2,424,800	.....
Cananea	2,948,000	2,834,000	.....
Moctezuma	2,687,712	2,446,731	.....
Other Foreign:			
Cape Cop., S. Africa	786,440	725,760	.....
Kyshtim, Russia	1,055,000	.....	.....
Spassky, Russia	649,600	.....	.....
Famatina, Argen.	.....	.....	.....
Tilt Cove, Newf'd.	109,059	104,992	.....
Exports from:			
Chile	6,720,000	3,584,000	.....
Australia	7,164,000	8,064,000	.....
Arrivals in Europe†	10,868,680	12,559,680	.....

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.
*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
IV, 1911	118,085,223	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year	1,431,938,338	709,611,605	754,902,233
I, 1912	119,337,753	62,343,901	80,167,904
II	116,035,809	56,228,368	63,148,096
III	125,694,601	67,487,466	58,779,566
IV	125,464,644	69,513,846	53,252,326

	Visible Stocks		
	United States	Europe	Total
V, 1911	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912	89,454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843
III	62,939,988	141,142,400	204,082,388
IV	62,367,557	136,819,200	199,186,757
V	65,066,029	134,176,000	199,242,029

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

new Hidden Creek smeltery. North Butte also proved disappointing by selling down almost $5.75 to $26. St. Mary's Mineral Land fell $8 from its recent high price. Lake Copper $6.25 to $38.25.

Curb trading has been light and prices generally heavy.

Assessments

Company	Delinq	Sale	Amt
Algomah, Mich	Jan. 22	.....	$1.00
Alpha Con., Nev	May 29	June 19	0.05
Andes, Nev	May 28	June 18	0.05
Black Jack, Utah	Feb. 6	.....	0.01
Caledonia, Nev	May 21	June 11	0.10
Cedar-Talisman, Utah	Apr. 20	.....	0.005
Con. Virginia, Nev	Apr. 24	May 15	0.20
East Tintic, Utah	May 30	June 25	0.005
Ely Con., Nev	.....	.....	0.05
Exchequer, Nev	May 23	June 13	0.05
Federal Ely, Utah	May 8	June 8	0.01
Glen Dale, Utah	May 25	June 25	0.001
Gould & Curry, Nev	Apr. 19	May 10	0.05
Hale & Norcross, Nev	Apr. 12	May 3	0.05
Hancock, Mich	Mar. 28	.....	1.00
Houghton Copper, Mich	May 17	.....	1.00
Julia, Nev	May 15	June 5	0.05
Lehi Tintic, Utah	Feb. 29	.....	0.01½
Lower Mammoth, Utah	Mar. 16	.....	0.01
Michigan Cop. & Gold, Utah	May 15	May 30	0.002½
New York Bonanza, Utah	May 8	.....	0.02
O. K. Extension, Utah	Apr. 26	May 15	0.002½
Ojibway, Mich	Jan. 10	.....	1.005
Raven, Mont	Feb. 1	.....	0.10
Savage, Nev	June 4	June 26	0.10
Southwestern Miami, Ariz	Jan. 15	.....	1.00
Union Con., Nev	May 9	May 31	0.15
Utah Antimony, Utah	June 1	.....	0.03

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52.222	59.043	23.794	24.081	27.190
March	51.454	52.745	58.375	23.690	24.324	26.875
April	53.221	53.325	59.207	24.483	24.595	27.284
May	53.870	53.308	.....	24.797	24.583	.....
June	53.462	53.043	.....	24.651	24.486	.....
July	54.150	52.630	.....	25.034	24.286	.....
August	52.912	52.171	.....	24.428	24.082	.....
September	53.295	52.440	.....	24.567	24.209	.....
October	55.490	53.340	.....	25.596	24.594	.....
November	55.635	55.719	.....	25.680	25.649	.....
December	54.428	54.905	.....	25.160	25.349	.....
Year	53.486	53.304	.....	24.670	24.592	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12.295	14.094	12.680	14.337	55.600	62.760
February	12.256	14.084	12.611	14.329	54.974	62.893
March	12.139	14.698	12.447	14.868	54.704	65.884
April	12.019	15.741	12.275	15.930	54.034	70.294
May	11.989	.....	12.214	.....	54.313	.....
June	12.385	.....	12.611	.....	56.365	.....
July	12.463	.....	12.720	.....	56.673	.....
August	12.405	.....	12.634	.....	56.266	.....
September	12.201	.....	12.508	.....	55.253	.....
October	12.189	.....	12.370	.....	55.170	.....
November	12.616	.....	12.769	.....	57.253	.....
December	13.552	.....	13.768	.....	62.068	.....
Year	12.376	.....	12.634	.....	55.973	.....

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41.255	42 529	July	42.400	.....
February	41.614	42.962	August	43.319	.....
March	40.157	42.577	September	39.755	.....
April	42.185	43.923	October	41.185	.....
May	43.115	.....	November	43.125	.....
June	44.606	.....	December	44.655	.....
			Av. Year	42.281	.....

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4.483	4.435	4.334	4.327	13.009	15.619
February	4.440	4.026	4.266	3 946	13.043	15.738
March	4.394	4.073	4.238	4.046	13.122	15.997
April	4.412	4.200	4.262	4.118	12.889	16.331
May	4.373	.....	4.223	.....	12.984	.....
June	4.435	.....	4.292	.....	13.260	.....
July	4.499	.....	4.397	.....	13.530	.....
August	4.500	.....	4.406	.....	14.260	.....
September	4.485	.....	4 356	.....	14.744	.....
October	4.265	.....	4.139	.....	15.332	.....
November	4.298	.....	4.181	.....	15.821	.....
December	4.450	.....	4.332	.....	15.648	.....
Year	4.420	.....	4.286	.....	13.970	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5.452	6.442	5.302	6.292	23.887	26.642
February	5.518	6.499	5 368	6.349	23.276	26 661
March	5.563	6.626	5.413	6.476	23.016	26.048
April	5.399	6.633	5.249	6.483	23.743	25 644
May	5.348	.....	5 198	.....	24.375	.....
June	5.520	.....	5.370	.....	24.612	.....
July	5.695	.....	5.545	.....	25.006	.....
August	5.953	.....	5.803	.....	26 801	.....
September	5.869	.....	5.719	.....	27.750	.....
October	6.102	.....	5.951	.....	27.256	.....
November	6.380	.....	6.223	.....	26.795	.....
December	6.301	.....	6.151	.....	26,849	.....
Year	5.758	.....	5.608	.....	25.281	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15.90	$15.12	$14.40	$13.32	$14.75	$14.00
February	15.90	15.03	14.50	13.28	14.81	14.01
March	15.90	14.95	14.65	13.66	14.96	14.10
April	15.90	15.13	14.65	13.90	15.00	14.15
May	15.90	.....	14.30	.....	14.72	.....
June	15.90	.....	14.06	.....	14.56	.....
July	15.90	.....	14.03	.....	14.53	.....
August	15.90	.....	14.00	.....	14.47	.....
September	15.90	.....	13.57	.....	14.40	.....
October	15.43	.....	13.44	.....	14.34	.....
November	14.92	.....	13.30	.....	14 25	.....
December	15.15	.....	13.10	.....	13.90	.....
Year	$15.72	.....	$13.94	.....	$14.49	.....

STOCK QUOTATIONS

COLO. SPRINGS May 7

Name of Comp.	Bid.
Acacia	.05
Cripple Cr'k Con.	.01⅛
C. K. & N.	.16
Doctor Jack Pot	.06
Elkton Con	.60
El Paso	.76
Findlay	.04
Gold Dollar	.16½
Gold Sovereign	.01½
Isabella	.12
Jack Pot	.05
Jennie Sample	.05½
Lexington	‡ 01
Moon Anchor	.01
Old Gold	.03½
Mary McKinney	.67
Pharmacist	.01½
Portland	.90
Vindicator	.73
Work	‡.01

SALT LAKE May 7

Name of Comp.	Bid.
Beck Tunnel	.14
Black Jack	.17½
Cedar Talisman	.02½
Colorado Mining	.17
Columbus Con	.13
Crown Point	.03½
Daly-Judge	6.25
Grand Central	.68
Iron Blossom	1.20
Little Bell	.40
Lower Mammoth	.02½
Mason Valley	11.50
May Day	.09¾
Nevada Hills	1.80
New York	.04½
Prince Con	1 37½
Silver King Coal'n	2.12½
Sioux Con	.04
Uncle Sam	.19
Yankee	‡.10

TORONTO May 7

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	6.90	Hollinger	12.00
Hudson Bay	‡70.00	Imperial	.04
Temiskaming	.39	Pearl Lake	.17
Wettlaufer-Lor	.64	Porcu. Gold	.37
Apex	.04	Porcu. Tisdale	‡.04
Central	‡5.56	Preston E. D	.06
Crown Chartered	.25	Rea	.55
Dobie	.45	Standard	.03
Dome Exten	.51	Swastika	.18
Foley O'Brien	.20	West Dome	‡.15

SAN FRANCISCO May 7

Name of Comp.	Clg.
COMSTOCK STOCKS	
Alta	.15
Belcher	.52
Best & Belcher	.07
Caledonia	1.37½
Challenge Con	.14
Chollar	.07
Confidence	.75
Con. Virginia	.73
Crown Point	.65
Gould & Curry	.06
Hale & Norcross	.25
Mexican	2.97½
Occidental	.55
Ophir	1.42½
Overman	1.15
Potosi	.07
Savage	.12
Sierra Nevada	.33
Union Con	1.17½
Yellow Jacket	.97

Name of Comp.	Bid
MISC. NEV. & CAL.	
Belmont	10.25
Jim Butler	.62
MacNamara	.25
Midway	.64
Mont.-Tonopah	3.40
North Star	.24
West End Con	2.20
Atlanta	.25
Booth	.10
C.O.D. Con	.10
Comb. Frac	.13
Jumbo Extension	.43
Pitts.-Silver Peak	1.35
Silver Pick	.13
St. Ives	.30
Tramp Con	‡.01
Argonaut	2.25
Bunker Hill	4.50
Cent. Eureka	1.00
So. Eureka	4.00

N. Y. EXCH. May 7

Name of Comp.	Clg.
Amalgamated	81¼
Am. Agri. Chem	60
Am.Sm.&Ref.,com	84⅛
Am. Sm. & Ref., pf.	108
Am. Sm. Sec., pf. B	88½
Anaconda	41¼
Batopilas Min	2
BethlehemSteelpf	70¾
Chino	28¾
Federal M. & S., pf.	41
Goldfield Con	4½
GreatNor.,ore.,ctf.	39⅞
Homestake	‡93
Miami Copper	25
Nat'nalLead,com.	56¼
National Lead, pf.	109
Nev. Consol	21⅛
Pittsburg Coal, pf.	87
Ray Con	18⅝
Republic I&S,com.	22⅛
Republic I & S, pf.	77⅛
SlossSheffi'd,com.	48
Sloss Sheffield, pf.	‡100
Tennessee Copper	42
Utah Copper	61
U. S. Steel, com	65½
U. S. Steel, pf.	109¾
Va. Car. Chem	51¾

N. Y. CURB May 7

Name of Comp.	Clg.
Barnes King	¼
Beaver Con	.46
Braden Copper	5⅛
B. C. Copper	5⅝
Buffalo Mines	‡1¾
Butte & Vipond	‡.53
Caledonia	‡¾
Con. Ariz. Sm.	⅝
Davis-Daly	1 1/16
Diam'field-Daisy	11
Ely Con	1/16
Florence	.76
Giroux	5¼
Gold Hill Con	‡¼
Greene Cananea	8½
Greenwater	.06
Guggen. Exp	217
Inspiration Con	18¾
Internat. S. & R.	‡126
LaGrange Placer	‡2⅝
Kerr Lake	‡2⅞
La Rose	3¾
McKinley-Dar-Sa	1⅝
Min. Co. of A. new	3¾
Nev. Utah M. & S.	1/16
Nipissing Mines	7¾
Ohio Copper	1⅝
Pacific Sm. & M	⅛
Precious Metals	‡1½
Ray Central	2⅝
Red Warrior	‡1⅛
South Utah M. & S.	⅞
Standard Oil (Old)	‡880
Stand'd Oil of N.J.	383
Stand'd Oil Subs.	490
Stewart	1⅜
Tonopah	6⅞
Tonopah Ex	‡1⅛
Tri-Bullion	1/16
Tularosa	1/16
United Cop., pfd.	10
Yukon Gold	3¾

LONDON May 8

Name of Com.	Clg.
Camp Bird	£1 10s 7d
Dolores	1 10 0
El Oro	0 17 0
Esperanza	1 12 0
Mexico Mines	7 0 0
Oroville	0 4 6
Stratton'sInd.	0 3 1½
Tomboy	1 3 3

BOSTON EXCH. May 7

Name of Comp.	Clg.
Adventure	7¾
Ahmeek	295
Algomah	7⅛
Allouez	41
Am. Zinc	29⅛
Ariz. Com., ctfs.	5⅛
Bonanza	.35
Boston & Corbin	6⅞
Butte & Balak	4
Calumet & Ariz	67½
Calumet & Hecla	475
Centennial	22
Con. Mercur	.06
Copper Range	56¼
Daly West	5⅝
East Butte	13
Franklin	12
Granby	53⅝
Hancock	35
Hedley Gold	17
Helvetia	1¼
Indiana	19¾
Island Cr'k, com.	46
Island Cr'k, pfd.	87½
Isle Royale	25
Keweenaw	2
Lake	36⅝
La Salle	6
Mass	6½
Michigan	3
Mohawk	60
New Arcadian	4½
New Idria Quick	6⅞
North Butte	27
North Lake	6¾
Ojibway	4½
Old Dominion	51⅞
Osceola	112
Quincy	85½
Shannon	13
Shattuck-Ariz	21
Superior	32
Superior & Bost	2⅛
Tamarack	36
Trinity	6
Tuolumne	3½
Union Mines	‡3⅛
U. S. Smelting	35
U. S. Smelt'g, pf.	48⅞
Utah Apex	2¾
Utah Con	13½
Victoria	4½
Winona	5¾
Wolverine	105
Wyandot	2½

BOSTON CURB May 7

Name of Comp.	Last
Bingham Mines	2⅜
Boston Ely	1½
Boswyocolo	.08
Butte Central	6½
Cactus	.12
Calaveras	1⅜
Chief Cons	1½
Corbin	2⅛
Cortez	1⅞
Crown Reserve	3⅛
First Nat. Cop	2⅛
Majestic	.66
Mazatan	‡.60
Moneta Porc	.12
Nevada-Douglas	3⅜
New Baltic	3⅝
Oneco	2⅝
Raven Copper	.30
Rhode Island Coal	.11
San Antonio	‡3
S. W. Miami	7⅜
South Lake	6½
Trethewey	.60
United Verde Ext.	.42
Vulture	‡5.00

‡Last quotation.